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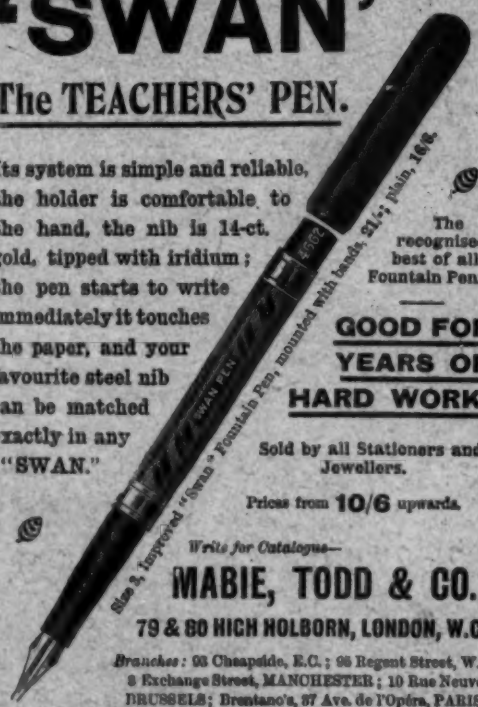


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# Educational Opinion.

J. H. Yoxall, M.A., M.P.
(*Photo by W. S. Stuart, Richmond.*)

MR. YOXALL has made his mark as teacher, politician, statesman, journalist, novelist, *lávengro*, connoisseur, essayist, wanderer, educational ambassador, and genial critic. It is a stupendous list, but the helmsman of the N.U.T. is yet to undertake another task, which in itself is usually enough, and occasionally more than enough, to task all the energy, resource, and patience (and especially the patience) of a full-grown, well-developed Englishman. He is, in short, as many of our readers are already aware, to become Editor of the new *Schoolmaster*, when the Union at last acquires the right to play its own organ. To say that he is well equipped for the task sounds impertinent at this time of day. But we can at least with all heartiness wish him the success which he will undoubtedly deserve.

*The Secretary—*

⁂ ⁂ ⁂

IT is, as we have said, a wonderful record, and it is aptly summarised by Mr. Yoxall himself in his newest volume, for which see page 534 of this issue. "I am," he writes, "that happy wight with the nomadic mind whose thoughts go journeying ever, and somewhat have I travelled in the realms of gold. Through the present and into the past; amidst hoary white civilizations, eschewing the ugly new; into Green Vaults and Festspielhausen, Bodleians, Alt Pinacotheks, and Salons Carré; into the proudest Parliament; into cabinets of thought and foyers of action, labyrinthine streets of the city of Mansoul, and calm domains of Academe; best of all, I trust, into lenient pasture of pity and aid and pardon, 'studious for that most excellent gift of charity, the very bond of peace and all virtues, without which whosoever liveth is counted dead.'... It is worldly-wise to be one-sided; it is joy to be many-sided; perhaps to be whim-sided is happiest of all."

*And his Record.*

⁂ ⁂ ⁂

MR. A. H. D. ACLAND'S plunge into "complete pessimism" at the annual meeting of the National Education Association was calculated to cause a thrill of apprehension throughout the country. As an educational authority his words are received with respect, and carry great weight. Still, the question springs unbidden, "Is this pessimism justified?" Mr. Acland was speaking of the education of the country regarded from a broad, national point of view, and he based his estimate on (1) the apathy of public opinion in the matter; (2) the frittering away of strength through the continued irritation of an unsettled religious difficulty; and (3) the impossibility of procuring from any Government the sums of money necessary for providing an adequate system of education. We have, then, a simple means to hand of testing the justifiability of Mr. Acland's pessimism.

*Mr. Acland's Pessimism.*

As far as public opinion goes, one must confess he is in the right. As a platform topic, nothing is so much in people's mouths as education; as a practical necessity, nothing is further from their interest. When, as happened the other day, operatives can themselves cast out by a huge majority a proposition to abolish half-time factory labour for children, it is useless to talk about interest in education so far as that class of the population is concerned. At the other end of the scale the opinion might be repeated, in witness whereof think of the discussions concerning Army examinations reported last month in these columns.

⁂ ⁂ ⁂

IF the first count is proved, the second is not far from being equally true. For the damage that accrues from the unsettled religious difficulty is not felt so directly in the schools themselves as in the division and opposition introduced among those who constitute the real driving force in education in the country—a much more mischievous evil. As for the third count, it is unfortunately completely true. Naturally, the apathy of the country at large assists this, since, when the interest of the country is definitely excited about a thing or a policy, ways and means of carrying that interest into effect are usually found. But although politicians of all parties are united in insisting on the necessity of continued schooling up to seventeen or eighteen years of age, of trade schools, and a wide extension of manual training, with all that medical inspection brings in its train in addition, no politicians of any party insist on the provision of the wherewithal to bring about this much-to-be-desired consummation. It really seems as if Mr. Acland's de-

*His Reasons.*

BRITISH MUSEUM

spairing remarks are well founded, if we look at the education of the country as a whole, and do not look merely at the few shining exceptions with which we may be acquainted.

UNTIL the supplementary, unqualified teacher is extinct; until classes are brought down to a maximum of thirty-five or forty children; until the slum-school policy which was the policy of the early School Boards has been reversed, and the schools squeezed into the slums of the towns are replaced by buildings and conditions which allow of the best use being made of the money spent on the education given in them; until a complete medical inspection of children of school age is backed up by the proper treatment of the maladies under which these children suffer; until the wastefulness of trying to educate the brain of a child whose body is only partially nourished is recognised; and until the great leakage which occurs between the ages of fourteen and eighteen is stopped—until then it is hardly possible to talk of the system of education as being efficient or adequate to the nation's needs. For all this, money is needed, and so long as the public opinion of the mass of the population is absolutely indifferent, so long will these things remain in the list of *desideranda*. Englishmen as a whole have never yet realised that the nation which does not set store on education will inevitably be beaten in the race by the nations which do. And if Mr. Acland's outburst of pessimism forces people to think, it will have done real service.

*The Cure.*

SIR GEORGE WHITE, who spoke on the same occasion, said that one way in which money might be saved is the consolidating of small schools into large ones. This question of large schools has been more than once mooted and discussed, and opinion leans to the position that schools of large size are not always efficient in proportion to their size, however economical such an arrangement may be in staffing and equipment. There is a point at which the large school becomes a barrack. But if Sir George White meant the consolidation of the small schools in the rural districts, where possible, and their replacement by a larger, better, central one, opinion would probably support him. And a striking confirmation can be found in the practice which has come into vogue in some of the eastern states and in some of the states of the middle west of America, of abandoning small country schools in a county, and building a large fully-equipped and staffed central building, to which the children from distant homes are conveyed at the expense of the authority.

*Consolidation —A Suggestion.*

AS the session rolls rapidly on the burning question once more comes uppermost, "What of appointments for the students who are now fast completing their college course?" If, as occurred last year, a considerable proportion of them go to swell the ranks of unemployed teachers, something approaching a grave educational scandal will arise. To urge, on the one hand, that teachers should all be trained, and, on the other, to permit of the employment of larger numbers of the untrained, unqualified, supplementaries, is so thoroughly Gilbertian a proceeding that in time the farce of it must strike even the official mind. Either of two reforms, both of which are badly needed, would save the situation—the gradual euthanasia of the supplementary, or the reduction of classes to a workable maximum of children. Apropos of this difficulty of finding posts, it would seem that it has already produced its due effect on the supply of candidates for admission to training colleges in 1909. In many cases the number of applications has fallen much below expectations.

*The Unemployed again.*

THE cause of children is "looking up" in the United States. A proposal is on foot in Hartford, Connecticut, to form a commission of juvenile affairs, consisting of the mayor, the superintendent of schools, and a number of other members drawn from parks, health, schools, charity, and other committees; the said commission to interest themselves in all matters relating to the welfare of the forty thousand children of the city, to collect statistics and other information concerning child life, and to recommend legislation in the interests of the children. A public-spirited policy which is worthy of imitation. And a Bill is now before the legislature of the State of Washington, requiring the acquisition of playground space adjoining, or in immediate connection with, any new school. The Bill specifies sixty square feet per child as the minimum playground; and, wonder of wonders, provides for *the removal from office*, and disqualification for future service, of any school director who by vote fails to comply with the requirements of the Bill! The Bill ought to be described as "A Bill to Provide for the Extirpation of Obstructionists on Education Committees," or "A Short Way with Reactionaries." What a blessing could we but borrow the Washington way for a short time.

*Home Legislators, please copy!*

FROM time to time echoes of the American teachers' visits to England float across the Atlantic after their return home. In the February *Journal of Education* one of them, evidently a teacher of history and literature, gives a most sympathetic account of her visit, and of the feelings stirred in her by the historical towns and monuments she visited. Southampton, Chester, Stratford-on-Avon, Norwich, Louth, and a score of places besides, lived for her in a new light—the light of their literary and historical associations. She is so intelligently sympathetic that we suspect she prepared pretty exhaustively for her trip, although she modestly declares it really requires a three-years' course of historical reading. She gives little passing notes of criticism. The development of school dancing in many parts of the country struck her forcibly as a valuable innovation; and she makes a pathetic little reference to the "air of repose" in the English schoolrooms, and the "pleasant, well-modulated voices" of teachers and children. English teachers will wonder at that remark about an "air of repose." Compared with American schools, it is, nevertheless, quite true. From experience we know the nervous restlessness of the American child, just as well as we know the loud, somewhat strident American voice: English teachers will be glad to know how much some of their American cousins have appreciated the old country and its ways.

*An Appreciation from America.*

# Useless Education.

## A SCATHING INDICTMENT OF THE PRIMARY SCHOOLS BY THE POOR LAW COMMISSIONERS.

*"The cost of elementary education in this country in 1905–6 is stated to be twenty millions sterling. This is an almost entirely new national charge since 1870. It should have steadily reduced unemployment and diminished pauperism. If it has failed in this, its accepted mission, it cannot be said that the failure is due to lack of funds. The desire of the young to raise themselves in the social scale and improve their position should ever be encouraged, but this desire seems to us too frequently to take the shape of trying to avoid handicraft and manual labour by recourse to other occupations which, though they are associated with a black coat, are less remunerative and less progressive than skilled handiwork. Clerical labour is a glut upon the market; high-class artisans are, according to our evidence, at times obtained with difficulty. We doubt if the atmosphere of our school life is altogether congenial to a career of manual labour. We would suggest to the Board of Education the advisability of meeting these criticisms by a thorough reconsideration of the time-table and curriculum in our elementary schools, as well as of the aims and ideals of elementary education."*

---

## REPORT OF THE POOR LAW COMMISSION.

IT is only possible to estimate the effect of our primary education by examining the "finished" product. Therefore if the Poor Law Commissioners have drawn their conclusions from observations of the adult worker (or shirker) of the present day, their indictment refers to the primary education of fifteen or twenty years ago. At that time the teaching profession had little or no choice in the matters of curriculum and method, and almost the entire responsibility for the results of their work must rest upon the shoulders of those who issued Departmental orders and paid or withheld Departmental grants.

The evils pointed out in the above indictment have not been discovered by the Poor Law Commissioners. They were recognized considerably more than a decade ago, and in every progressive school in the land efforts are now being made to obviate them for the next generation.

It is taken for granted that every child must be taught to read, write, and use the mother tongue, to reckon, to observe, and to make use of his hands. This is the minimum upon which almost all are agreed, and among the most up-to-date teachers, *who are not hampered by the necessity for cramming candidates for scholarships in secondary schools*, there is a consistent effort to make each lesson bear upon the everyday life of the pupils as future British citizens. This is to interpret the "practical" outcry in the broadest possible manner.

The Commissioners are, on their own showing, entirely ignorant of what is going on in this direction. The reading of the primary school pupil, once he has learnt the rudiments, is planned to enable him to obtain useful information—general, geographical, and historical—and to provide him with a wholesome means of recreation. He no longer writes "essays" but letters (applying for situations!) and accounts of actual experiences, and he is generally trained to express himself clearly both orally and upon paper. The old-fashioned grammar has vanished. School arithmetic tends to become so practical that it is losing some of its training value. Nature study properly used places the pupil in touch with his immediate environment, and trains those observing powers without which the most hard-headed practical man would never have built up a fortune. Manual work and drawing (new style) train hand and eye in a way which is equally good for future carpenters and Poor Law Commissioners. If the curriculum in the best schools has a fault, it tends to become so practical that our pupils run the danger of being well trained to make a living, while they are not taught to live, in the higher sense of the term.

Of course there are schools which adhere to the old methods, but as often as not they are dragooned by old-fashioned inspectors and directors of education. And even in our progressive schools there is too much attempted. Overawed by the details of the Board of Education's *Suggestions*, earnest teachers develop each branch of the school work to an absurd degree, and the curriculum requires simplifying in a drastic manner.

Further, the manual work is ripe for extension and reform. The lower standards require more constructive work. And here, too, we know of schools which are earnestly grappling with this problem. Next month we intend to commence a new feature of this journal, to be entitled "THE NEW CONSTRUCTIVE MOVEMENT," and we hope to show during the year what is being attempted in this direction, as well as to offer practical suggestions and schemes of work for those of our readers who desire to meet the objections of the critics who assert that our primary schools are mere forcing grounds for abnormal office boys. Further, we commence this month (see p. 531) a series of helpful articles for teachers who are preparing upper standard and higher elementary pupils for technical and trade schools, and for evening school workers generally.

Meanwhile we have taken the opinion of a few representative contributors on the matter of the Commissioners' indictment, and these we beg to offer for the consideration of our readers, contenting ourselves merely by contributing the following irresponsible queries to the discussion:—

1. When all our primary pupils have become skilled manual workers, from which European nation will our great towns draw the harmless, necessary clerk?

2. What do the Commissioners suggest as the best scholastic preparation for the work of a navvy, or a coal-heaver, or a stoker on the *Mauretania*?

3. Why should not a van boy rise to be a Poor Law Commissioner?

4. How many Presidents of the United States have been errand boys?

5. What right or power has any primary schoolmaster to direct his pupils to one "state of life" rather than another?

## I.—MR. YOXALL'S VIEWS.

[We have asked for Mr. Yoxall's views on this matter, and give the substance of his remarks.]

"NO boy or girl physically and mentally capable of learning may now go out into the world without, at any rate, a fair educational knowledge." So say the Poor Law Royal Commissioners, giving another proof how blank to some of the bottom facts even the most industrious and able Royal Commissioners may remain. Not a teacher in the land who could not controvert that statement from first-hand knowledge. The meshes of the net are still large, and still in places broken; a good many fish swim out unschooled.

The Commissioners also say that "practically the education of the people in England and Wales dates back only seventy years." It does not "date back" anything like so long. Some elementary *instruction* dates as far back as that, but "education" is more nearly twenty than seventy years old.

And then a nation which neglected its plain duty in this matter longer than any state in Europe did, almost, goes on to grumble about "Useless Education." And I suppose we shall see a new impetus given to the movement for making education in school more "practical," as the shibboleth goes. Now, what is called "practical" education is as a rule not educational at all; it is instruction, and school life is not long enough for instruction and education too.

The *soi-disant* reformers who would practicalise school work would thereby destroy the only chance of education which English elementary school children have had since 1889. Robert Lowe sought to "practicalise" education in 1862, and the immense mischief he did—by-the-bye, he did it because of the report of a Royal Commission—lasted on for nearly thirty years.

No education is useless, no education is unpractical. What we want for the schools is not less but more education, and a good deal less "instruction" than is given in them to-day.

No education can be useless, but most "instruction" is useless for children of five to fourteen. Prescription of a practicaliser: Take a human gallipot, pour in a gill of Scripture, ditto of arithmetic, half a gill of penmanship, half a gill of reading aloud, a quarter of a gill each of geography, history, drawing, and singing. Shake up. Cork. Label. Deliver. If any gallipot's contents be not found up to sample, censure the teachers, and shout "Useless Education."

My own prescription: Let the little human gallipot stand, eyes and ears open, in the atmosphere of an intelligently-conducted school. Let germs of love for reading books, for knowing about places, people, and things, for finding out matters which have the attractive aspects of mysteries, for music, for pictures, for chronicle and biography and imaginative story, for handiness and for daintiness, and for all forms of loveliness, be deposited out of the kindly atmosphere, within the little receptacles. Let these germs grow, let intellectual and moral ferment be set up, let thoughts arise, and originality develop. And *don't* cork, nor label; let the little gallipot stand open always, wherever it be. That is education; that will produce an adaptive, flexible, joyfully working creature; that in time will remove the reproach.

And yet there are quidnuncs on Education Committees already trying to bring back individual examinations, rigid curricula, and all the paraphernalia of what they think "practical" and "useful" in school!

## II.—THE USELESSNESS OF EDUCATION.

### HOW FAR IS THIS CHARGE TRUE?

BY C. T. HUNT.

"*Elementary education should have steadily reduced unemployment and diminished pauperism.*"

THAT it has diminished crime is admitted by all. Has the last forty years of primary education only crushed the daring ones, and left the others without the initiative and resource that alone can make the working-classes a virile, self-respecting body? And if so, is it only on the back of that education that all the grievous results are to be laid?

Is it the fault of our elementary education that parents living on the verge of starvation should expect their offspring at the moment of leaving school to earn some wage substantial enough to ease the grinding poverty under which the family lives? Is it the fault of our elementary education that employers requiring clerks, van boys, messengers, etc., will use the young people, only to dismiss them when they grow older and demand higher wages? Is it the fault of our elementary education that employers who, by the aid of machinery, can carry on their work with boy and girl labour will only use such labour? Is it the fault of our elementary education that masters will not take upon themselves the responsibility of training apprentices? Is it the fault of our elementary education that many of the workers themselves, who are trade unionists, should be so shortsighted as to discourage apprenticeship altogether?

Since 1870 a generation of parents has arisen that may rightly be called the product of compulsory primary education. Can it be said of these parents that they estimate the value of education so highly that they are willing to make every sacrifice for the proper development of their children; that they themselves have developed a high sense of their responsibilities as parents; and that they are willing as men and women to look to their educators for advice in the governance of their own or public affairs? This great question in all its parts must be answered in the negative.

Nevertheless there are grave weaknesses in our system of primary education, radical ones well known to teachers, and so these sociologists are justified in pointing the finger.

During the last forty years the educators of the country have been struggling with "droves" of sixty and seventy children. For the best part of forty years they have had to bring whole batches up to a specified standard, repressing by the inertia of non-progression the alert and promising, and struggling with the dull and jaded, many of whom had been doing a day's work before appearing at school. Was it possible to do much individual work with such large classes? From the schools came thousands of units all of the same type, monotonous, orderly, petty-souled crowds, educated—save the mark—to little forms of work, little views, little good, little crimes—no daring, no colour, no movement, nothing great.

To the lack of individual work must be added a second evil—the want of more practical work that would develop the resources of the children.

But for a long time the more capable teachers have been aware of all these evils, and have been constantly

fighting against them. Such teachers are always ahead of "Reports of Commissioners" and "Suggestions" from the Board of Education, and in and out of school have struggled manfully, sometimes even at the risk of the loss of their reputations as teachers, to obtain the right of the child to be properly educated. But they have not been always backed up, or even understood, either by the authorities or the public. However, things are changing for the better. The size of the classes is diminishing; teachers are encouraged to adopt those methods that will force the children to do more for themselves; and the work in nearly all the schools *is* becoming more and more practical, while many of the authorities are striving to raise it to its proper educational plane.

There have been established for some years small special classes in wood and metal work, drawing, science, and domestic work. That these classes have been as productive of the good that was expected of them there is very grave reason to doubt. The delight in craftsmanship, the delight in the doing of things, and the dignity of doing work well, are not too evident; and this is to some degree the result of the divorcement from the schools of the particular centres in which such work is carried on, and the lamentable estrangement between the two sets of teachers.

In this latter respect there must soon be a change, for the present arrangement only results in a direct division between manual and other forms of work, to the detriment of all the teaching, and is helping on the growth of those other out-of-school factors that produce the present day snobbish attitude towards manual work and workers—and this even in the children of such workers.

In many of these manual training centres too there has been a lack of that form of work which will cultivate the self-reliance of the children.

Further, there have been mistaken leaders among the teachers, who have done their utmost to limit the teachers' work with their pupils to the four walls of the school. This has been done largely to help weaker brethren whose self-sacrifice was being exploited by those in authority; but how much better would it have been to strengthen the weak ones, so that they were able to withstand any encroachments on their rights, and at the same time to do the work they had taken to their hearts. Instead, there has been cultivated an idea that school and out-of-school life are two different things rather than two parts of the same thing.

Lastly, our primary education has been compulsory, and therefore free. Such being the case a train of evils follows. Having forced the child into the school, extreme care must be taken of him. All must be done for him; he has to make no effort of his own; and now he has even to be taught to amuse himself—the saddest and most damning feature of the whole business. A child growing up under such conditions seldom wants to do anything for himself, and so his independence and power of initiative are passively lost. He is left to go out into the world an unenterprising unit, who must be set to any work he attempts; who would buy rather than make or mend; who nowadays has seldom a master directly interested in his welfare, no work that he can do from start to finish, and not even a chance of giving his very best, for he learns to know that he is only paid for so much—not for his best.

Therefore the teachers, backed by the authorities and public opinion, must continue to make their work more practical, their pupils more resourceful and self-reliant, and the whole atmosphere of the school such as will produce the children who will become living men and women, respecting knowledge and one another, loving their work, and capable of righting those other greater evils that are the stumbling-blocks to their proper growth as Englishmen.

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## III.—MANUAL DEXTERITY.

BY AN INSPECTOR OF SCHOOLS.

IN investigating the causes of pauperism the Commissioners find that the expenditure on education, which has risen from £2,000,000 in 1871 to £20,000,000 in 1905-6, has been ineffective in reducing pauperism, for say they: "Persons above fifty years of age have not participated in the advantages conferred in 1870, but of persons below that age there is no diminution in the number coming upon the Poor Laws."

We find on page 196 the following decisive pronouncement: "We have received evidence from all parts of the country, and especially from the rural districts, as to the incompleteness and unsuitability of the education in public elementary schools in preparing children for their after life."

It is, however, in the section on unemployment that we run the heaviest indictment to earth. The main cause of pauperism is shown to be casual labour, which is largely recruited by the product of boy labour. The almost universal experience is that in large towns boys, owing to the carelessness or selfishness of their parents, or to the desire for freedom on their own parts, plunge haphazard into occupations in which there is no future.

"Quite apart from the evils of street trading, such jobs as van boys and errand boys are merely preparations for the scrap heap of casual labour, and in numberless trades youths have no prospect of being absorbed into the adult labour of the factory." "Between 70 and 80 per cent. of boys leaving elementary schools enter unskilled occupations."

Of the applicants to the London Distress Committees 86 per cent. are London born. Having proved that boy labour feeds to a large extent the unskilled labour market, the Commissioners, relying upon a mass of evidence received, blame the educational system.

### Alleged Defects of our Educational System.

The case against the school may be briefly expressed by the following quotations:—

"If at school young people were taught first of all to 'think,' and if technical training were general, non-specialised, teaching principles rather than practice....."

"Some training should be given in primary schools in such things as drawing, the nature of materials and natural forces, and the general use of tools."

"Technical training does not meet the requirements of the shortsighted or broadminded employers."

"The education for working-men's sons should always be partly through manual work in the elementary school."

Finally, the position is summarised in Part VI., Chapter 4, page 409, in the following arguments:—

1. "1887. Mansion House Committee Report: Out of 394 men (111 under thirty years of age) interviewed, scarcely one could hope to improve his social position owing to neglect of education. So far administration of Education Acts has not given the people what is required."

2. Mr. Cyril Jackson reports: "There is a widespread feeling that education is too academic, and must be made more practical."

"It should be more combined than at present with manual training."

3. "School training should be more closely an adaptation of the child to its future life and occupation. We doubt if the atmosphere of our school life is altogether congenial to a career of manual labour."

"We would suggest to the Board of Education the advisability of thoroughly reconsidering the time-table and curriculum in our elementary schools, as well as of the aims and ideals of elementary education."

The following suggestions are offered :—

1. Make our education more practical.
2. Raise the exemption age to fifteen.
3. Only those who are entering a skilled trade should be exempt below fifteen.
4. School supervision to sixteen.
5. Establish an intelligence bureau in connection with every public elementary school for the purpose of advising parents and teachers as to branches of employment likely to give the best opening for children leaving school.
6. Boys and girls between fifteen and eighteen should be sent to classes giving physical and technical training for thirty hours per week, and should not be allowed to work more than thirty hours a week. (Minority Report.)

Let it at once be said that most educationists are entirely at one with these recommendations, except that the last, though advisable, is somewhat unpractical at present.

With reference to the criticisms on the primary school curriculum, it should be pointed out that the Board of Education and the Local Authorities have given ample evidence of being alive to the needs of the hour. Every one who is conversant with the administration of the Education Acts knows that the whole trend of elementary schoolcraft has for at least the last fifteen years been towards development of intelligence and self-reliance. (Compare the *Suggestions to Teachers* Blue Book.)

The recommendation respecting the teaching of drawing and manual work seems to be belated, for surely it is common knowledge that all children receive instruction in the former, and a large percentage of older boys in urban districts are taught wood or metal-work in workshops.

Finally, as further evidence that the Central Authority is alive to the importance of encouraging a gradual evolution from the worship of the pen and book to a wider and more suitable training of the brain through hand and eye, consider the following extract from the 1908 Code :—

"The school must at the same time encourage to the utmost the children's natural activities of hand and eye by suitable forms of practical work and manual instruction."

None more than those of us directly engaged recognise more fully the defects and the extent to which we fall short of the desired state of things. In the rural districts of England and Wales practical education is to all intents and purposes non-existent. No woodwork, very little cookery, and an inconsiderable amount of cottage gardening are taught in country schools. Only 570 departments (many of which were in urban districts) claimed grant for gardening in 1905–6.

On the other hand, for several years past Nature study has been a part of the curriculum of these schools, and in 1901 the Board issued courses of special object lessons and of gardening, while in 1908 a most valuable official pamphlet bearing on rural education set forth the value of manual training.

The time has now come for forcing the pace somewhat in these matters, but let us take count of the obstacles ahead. All experts agree that a revolution in methods is needed, but they stand in awe of the tremendous cost. The great stumbling-block to real advance now is the size of the classes. How can the teacher of fifty children cultivate much self-reliance and thought on the part of the individual child? As soon as handwork becomes general, you will, perforce, have to reduce the size of the classes and increase the number of teachers. What will the poor ratepayer have to say to this? To teach handwork adequately a separate room fitted up as a workshop is needed at any rate for older children. Here, again, a heavy expenditure awaits us.

The most valuable recommendations of the Commissioners are those dealing with the extension of school age and compulsory evening schools and intelligence bureaux. At present the age limit is nominally fourteen, but as a matter of fact a large percentage of children get away at thirteen and many at twelve by passing the Labour Certificate examinations. By raising the age to fifteen, and compelling employers to allow facilities by shorter hours of labour for evening school instruction, we shall forthwith cut deep into the cheap child labour curse, and so wage war on casual labour with its attendant evils, for the Post Office and other exploiters of boy labour will then be compelled to employ adults.

In conclusion, I would like to refer again to the deductions of the Commissioners to the effect that our academic system of education is partly responsible for the unemployment trouble. It seems to me that the logic is not altogether sound. They find that one of the chief causes of unemployment is uneducative boy labour, and they also know that our educational system is not sufficiently practical. These are truly coincident phenomena, like a morning red sky and rain; but, as it seems to me, the Commissioners' argument is very like a case of *post hoc, ergo propter hoc*.

The evil of boy labour, as I read it, is rather a result of our state of civilisation. Consider these quotations from the report :—

"The problem owes its rise in the main to the enormous growth of cities as distributive centres, giving innumerable openings for errand boys, milk boys, office and shop boys, bookstall, van, lorry, and trace boys, street sellers," etc.

"Very few boys can pick up skill after a year or two of merely errand-boy work" (page 325). "What stares in the face the exceptionally careful parent of the poorer class who tries to start his son well is in London the difficulty of discovering any situation in which his boy can become a skilled worker of any kind, or even enter the service of an employer who can offer him advancement. London employers refuse to teach apprentices even for premiums. In 1899 an inquiry showed that though 12,000 men were engaged in the building trades in London, there were only a few score apprentices instead of 2,000, the due proportion." (Part VI., Chapter 1, page 142.)

Whilst conceding that a more industrial training is desirable, yet in the face of these facts one is rather tempted to ask, "How would such *per se* kill the curse of uneducative boy labour, which seems a social much more than an educational question. We have the coincident facts of almost universal workshop training for London boys, and yet 70 per cent. admittedly pass into blind-alley occupations, and 93 per cent. of unemployed seeking aid at refuges and from distress committees in London are London-born, many of whom must have received this workshop training.

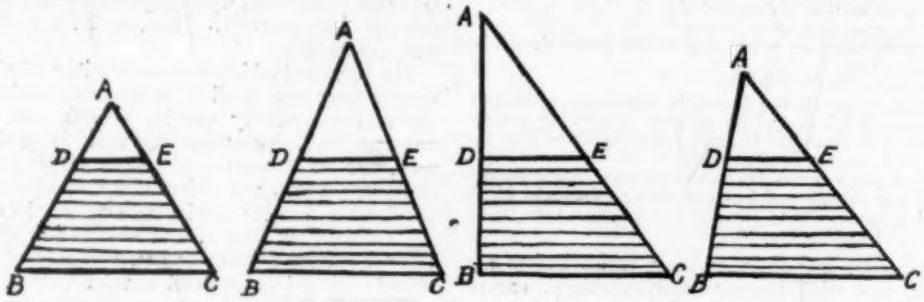
# ARITHMETIC *vid* MENSURATION.

BY J. L. MARTIN, ADCROFT SCHOOL, TROWBRIDGE.

## 1. The Trapezoid.

*First Step* :—Construction from triangles.

(1.) Draw in turn equilateral, isosceles, right-angled, and scalene triangles.




(2.) Take a point D in the side AB of each triangle, and draw a line DE parallel to the base. (See Figs.)

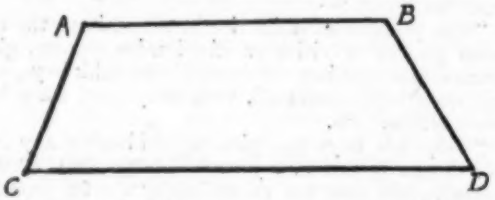
Each of these shaded figures is called a "trapezoid." How many sides has a trapezoid? Name the parallel sides.

(3.) Cover each of the triangles with tracing-paper, and copy all the angles marked ABC. Compare these with the angles ADE in each case. Similarly, compare the angles AED and ACB.

Observe that the lines AB and AC meet the parallel lines BC and DE, and that the corresponding angles ADE and DBC are equal, as are also the angles AED and ECB.

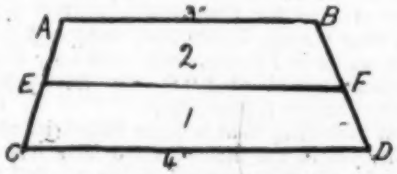
*Second Step* :—Direct construction.

Draw the parallel lines AB and CD any convenient length, and join AC and BD.



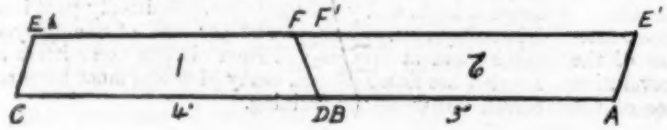

The figure ABCD is a "trapezoid." Notice the number of its sides and how many are parallel.

*Third Step* :—Draw a trapezoid, having its parallel sides 4 in. and 3 in. long.




(1.) Bisect AC in E and BD in F. Join EF, and number each of the parts 1, 2.

(2.) Cut out and transpose as shown below.




(3.) How is the above parallelogram made up? Compare its altitude with that of the trapezoid.

Let the children write as follows :—

The base CA = the sum of CD and BA (the parallel sides).

The altitude = half the altitude of the trapezoid.

Area of parallelogram = base × altitude.

Area of trapezoid = area of parallelogram.




Therefore area of trapezoid = the sum of the parallel sides × half the altitude.

*Fourth Step* :—

(1.) Find the areas of the following trapezoids :—

(*a*) Parallel sides, 7 in. and 9 in.; height, 4 in.

(*b*) Parallel sides, 220 yds. and 180 yds.; altitude, 75 yds.

(2.) A field in the form of a trapezoid has its parallel sides of 165 yds. and 192½ yds., and the distance between them is 110 yds. How many acres of land does the field contain?

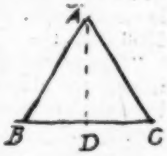
(3.) If the area of a trapezoid is 48 sq. in. and the parallel sides are 5 in. and 7 in., what is the altitude?

(4.) If the area of a trapezoid is 48 sq. in. and the altitude is 6 in., what is the sum of the parallel sides? If one of these sides is 9 in., what is the other?

## 2. The Hexagon.

*First Step* :—

(1.) Draw an equilateral triangle ABC on a base 10 cm. long. Drop a perpendicular AD from the vertex A on the base BC. Measure the length of AB. What part is it of the base? Call the base "S" and the perpendicular "*h*." Write down a rule for the area of the triangle.




$$\text{Area} = S \times \tfrac{1}{2}h.$$

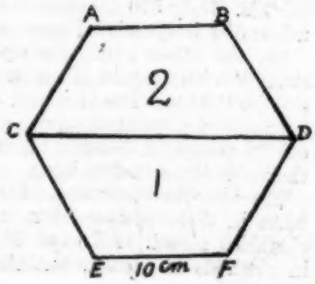
The perpendicular is nearly ·85 of the base; therefore it would be correct to write :—

$$\text{Area} = \tfrac{1}{2}S \times \cdot 85S.$$

(2.) Find the areas of equilateral triangles having sides of 4 in., 6 in., 9 in. (Answer in decimals of a square inch.)

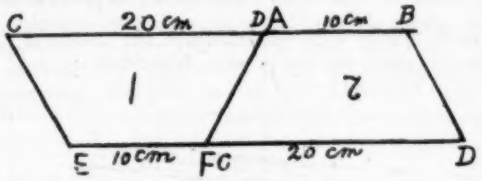
*Second Step* :—

(1.) Draw a regular hexagon, having a side of 10 cm. Join CD.



(2.) (*a*) Cut out the two parts ABCD and EFCD. What figures are formed? (Two trapezoids.)

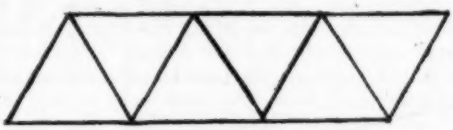
(*b*) Arrange as below.




(*c*) How many times is the side AB contained in AD? If we call the length of the side S, we can say that

Area of hexagon = $3S \times \frac{1}{2}h$.

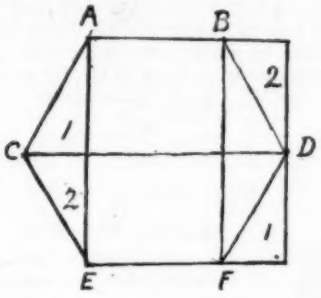
(3.) Divide the parallelogram ACFD (see above) into six equilateral triangles, and arrange as below.



It will readily be seen that the area of the regular hexagon is equal to that of six equilateral triangles.

Area of hexagon $= 6(S \times \frac{1}{2}h)$, where "$h$" represents height of triangle.

(4.) (*a*) Draw another similar hexagon on a piece of cardboard. Cut out and transpose the parts marked 1 and 2 to the position shown.




(*b*) What figure has been formed? How would its area be found? Measure the breadth of the rectangle, and compare it with a side of the hexagon. It will readily be seen that

Area of hexagon = $1\frac{1}{2}S \times H$.

(5.) Examine and compare each of the rules discovered for finding the areas of regular hexagons.

*Third Step* :—

(1.) Draw six regular hexagons varying in size of side, and find the area of each.

(2.) Find the areas of the hexagonal ends of prisms and pyramids which may be in school.

(3.) Draw any regular hexagon ABCDEF, and divide it into three equal rhombi.

(4.) Draw the hexagon again, and join FB, BD, and FD. What kind of triangle is formed?

(5.) Draw the hexagon again, and join AC and FD. What kind of quadrilateral is ACDF?

(6.) Draw the hexagon again, and join AC and FD, cutting CD, joined in L and M. Examine carefully each of the figures ALMF and CLMD. Are they squares or rectangles?

# GEOGRAPHY NOTES UP-TO-DATE.

BY E. R. WETHEY, M.A., F.R.G.S.

## BASUTOLAND AND THE COMING SOUTH AFRICAN "CONFEDERATION."

THE departure of the members of the Basutoland deputation from England on February 27 last marks the close of a noteworthy incident in the approaching union of all the forces in British South Africa. It was a rift—a little one sure enough—within the lute, which is now, it is to be hoped, well on the way to a satisfactory mending. Briefly, Basutoland was suspicious on the subject of "Confederation." Its natives had had enough of Colonial rule in years gone by, and were averse to any order of things which might remind them of their experience. Originally annexed by Cape Colony in 1871, they hardly ceased from rebelling against the annexation for thirteen years, at the end of which period they obtained their desire, changed masters, and came directly under the British Crown. This they liked, and with this they have professed satisfaction.

BASUTOLAND AND ITS NEIGHBOURS.
Railways.

At the first note of the movement for closer union in South Africa the Basutos became anxious. They wanted no change; Imperial rule, Imperial status, was good enough for them. But as time went on, and as it became obvious to their own native council that "union" was bound to come, they decided to fall in with the new ideas, provided that their own special rights and privileges should be properly safeguarded. Hence the deputation direct to their Imperial ruler, King Edward VII. The petition which they presented to the King prayed for three things:—(1) The retention of their "National Council;" (2) the preservation of native lands; (3) the prohibition of the entry of liquor into Basutoland.

The text of the King's reply, though not to be published until after the return of the deputation to Maseru, their capital, is understood to be favourable in every respect, so the Confederation *in posse* sees its first secession obstacle easily removed. For the rest, the deputation seems to have had a royal time. They were *féted* everywhere; they were mightily pleased with their Imperial overlord; they were welcomed by some of the busy towns of Yorkshire and Lancashire; and they saw the sights of London. It may even be conceived that the memories of their visit will reconcile them to the

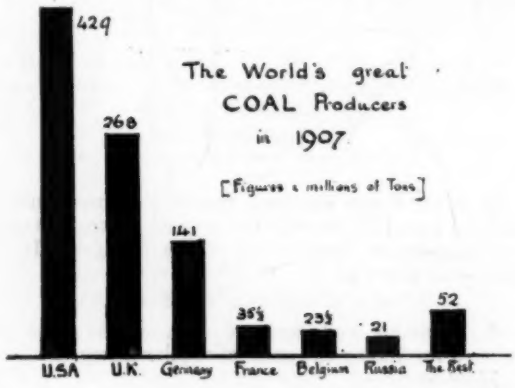
comparative tameness of the sights and scenes of their native country.

### Basutoland.

But, judging from most accounts, Basutoland is by no manner of means a bad sort of place to live in. For the most part a great plateau, sloping south and south-west from the Drakenbergs, it is a country of magnificent scenery—enthusiasts call it the "Switzerland of South Africa"—and, what is unusual in South Africa, of rivers which contain a constant supply of water. The climate is naturally bracing, and even on the lowlands (which, by the way, nowhere fall below 5,000 feet) frosts of fifteen to twenty degrees are not uncommon. The upshot of all is that Basutoland boasts the finest grain districts and cattle pastures in all the lands of the latest "United States." True, some observers of recent times note that all is not gold that glitters. Captain Crawshay, who spent ten months in 1901-2 travelling some 2,000 miles chiefly in the south-west of the colony, described the native population as "considerable but undesirable." Their ideas of sanitation and other things were "impossible." This may, however, have been the result of contact with equally undesirable whites from over their borders. There were other impediments in the way of developing intimacy. Dogs were everywhere, and such dogs! Cow-dung was the one and only fuel, for the original growth of low scrub had been cut down after the most wasteful system. The soil of the country bade fair to disappear under the continual attack of rain-flood and river-flood, and would go on disappearing until reservoirs were built and trees planted. All game had gone; British buttercups and British poppies lent a homely if inauspicious touch to the country-side. The much vaunted ponies were good certainly; but how could they help it—for the Basuto brings up his ponies on a Spartan system in which the fittest only survive? The native is a bad master to his beast, and absolutely without any bowels of compassion. But the captain admitted that there were possibilities. The cattle were fine and the grain was fine, and there were plenty of both. The air was magnificent, and wherever there were any Europeans there was prosperity. And these possibilities should work out well in the future. The country is half as large again as Wales, with a population of not much more than half Glamorgan's—that is, about 350,000 people on an area of over 10,000 square miles. There are less than 1,000 whites all told; indeed, white settlement is forbidden without special permits. The natural resources are wool, wheat, mealies, and Kaffir corn; iron, copper, and coal are said to exist. Imports take the form chiefly of blankets, ploughs, clothing, iron and tin ware, and groceries, to the tune of about £250,000 per annum, or slightly more than the value of the exports. Revenue and expenditure about balance each other at a little over £100,000 per annum. Communications are poor at present; bridges are badly wanted, and there is only one railway—a short sixteen-mile line connecting Maseru with the Bethlehem-Ladybrand branch from Bloemfontein. Administration is in the hands of a Resident Commissioner, under the High Commissioner for South Africa. The country is divided into seven districts, which are again subdivided into wards, each presided over by native chiefs, and all under Letsea, the present paramount chief. The land is held under a tribal communal system; there are no individual proprietors—a system which, though easily subject to abuse in the case of a strong wire-pulling chief, seems to work well, and the Basutos are happy. No wonder then they are afraid. They always have been. Their highlands cause precipitation of rain often when the white farmers of the lower plains of Cape Colony are gazing at a rainless sky, while on every hand are spruits void of water and a veld covered with dust. No wonder the Basutos are afraid. The white man is ever covetous, and nowhere more so than in South Africa.

### The World's Output of Coal.

It seems odd in these up-to-date times that one has to wait until the last week of February 1909 to get the world's official coal figures for 1907. But so it is. The task of compiling coal statistics is evidently one not to be lightly attempted, and our Board of Trade acts up to the occasion. There were plenty of estimates during 1908, but here at last are the real figures; and how striking they are! The total is close on to *one thousand* million tons, to which the United States contributes nearly half, and the United Kingdom rather more than a quarter. *En passant*, estimates are already docking anything from fifty to seventy million tons off this huge American total for 1908. The favourable conditions under which Philadelphia, which supplies 60 per cent. of the States coal, works—thick seams only, shallow mines, level adits rather than pits—must "worsen" in time, though the proximity of labour and markets should tell in its favour for many a year yet. But this stupendous world output is even more striking when viewed comparatively. To go no further back than the end of the nineteenth century is sufficient to show the enormous advance which has been made. It was just about the time when the United States of America began to beat the United Kingdom. The figures compared with those of the annexed diagram read 239, 225, 109, 33, 22, 13, 38—total, 679. It is the

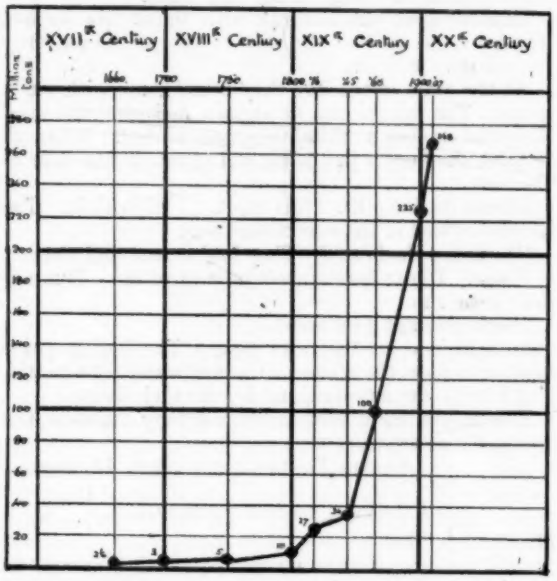



United States that is chiefly responsible for the great advance; the rest of the world prefers to jog along in much more demure fashion.

### The Progress of Coal in the United Kingdom.

Our own figures of progress, arranged graphically, show a curious curve. Since the early days of the seventeenth century, when it was discovered by Dud Dudley (son of Lord Dudley) that pit-coal could be used for smelting iron, enormous developments have naturally taken place, but they have been all crammed into the last fifty years of the third of the three centuries. A hundred years after Dudley's time Abraham

Darby of Coalbrookdale knew the secret, and used it, but it was not till the middle of the eighteenth century that it became generally known. The total output of British coal was then only some 5,000,000 tons. But

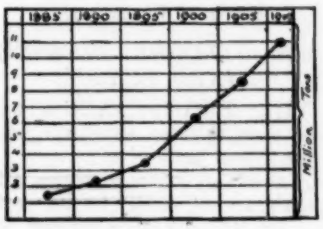



Coal Output of the United Kingdom at Different Periods.

the time was at hand for developments, if small at first. The "age of invention" commenced to run with the industrial revolution at the end of the century; by 1800 the steam age had begun, and the new demands for coal promptly doubled the output. In 1815 Sir Humphry Davy invented his famous lamp, and the greater security in the mines at once nearly trebled the output of fifteen years before. Then followed the first locomotive, early attempts at steam navigation, and the application of coal to lighting purposes. By the middle of the nineteenth century the railway era was rampant; by 1865 the United Kingdom for the first time touched 100,000,000 tons of coal. But startling though this progress was, and startling as it appeared to our fathers and grandfathers, it was nothing to what was to come. The table speaks for itself. It is indeed well to remember that the recent Royal (Coal) Commission has estimated that the supplies still available in the United Kingdom may be set down at some 150,000,000,000 tons. Verily there is nothing like statistics for instilling confidence.

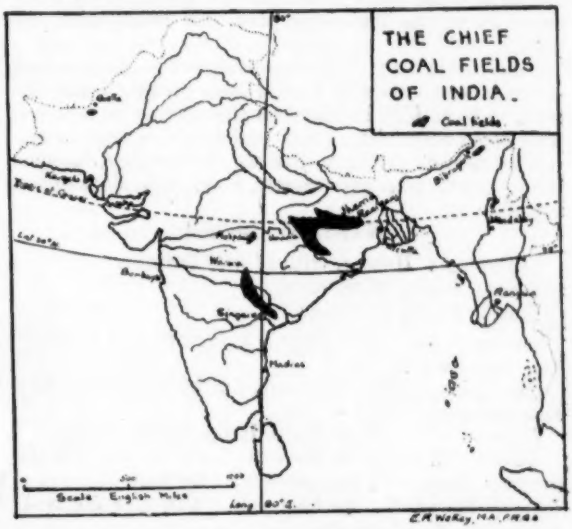
## Coal in India.

India is the first of our colonies and dependencies, and the only one as yet to show a tonnage output of double figures in millions. Neither Australia nor Canada is far behind. Roughly, the figures run—India, 11; Australia, 9½; Canada, 8; the Transvaal, 2½; New Zealand, 2; Natal, 1½. The Indian progress has been steadiness personified during the last twenty years. History relates that the first coal was mined in 1820, but it was not till sixty-five years later that as much as a million tons were produced. Since then (1885) the regularity of the upward curve in the diagram is most marked. Ninety per cent. of this Indian output comes from one district—the Jherria and Raniganj mines of Bengal. The other localities are indicated on the sketch map of the coalfields. One result of this steady progress has been the natural decline of coal imports. In the 'nineties they were estimated at 1,000,000 tons per annum; now they are under 200,000. Indeed, by 1901 Indian coal had supplanted British




India—Output of Coal.

nearly everywhere, and was pushing it back to Suez, as India began exporting some 9 to 10 per cent. of its own coal. Some such a result was to be expected when it was found that the East India Railway, using Indian coal, was paying little more than half an anna for its fuel per mile, while the Bombay and Baroda Railway, using British coal, had to pay four annas. And yet Indian coal is far inferior to British, or the latter would have gone to the wall long before. Tests prove that 130 tons of Warora coal can only do the work of 100 tons of Welsh coal. This, however, is neutralised by the exceeding cheapness of the Indian article. Its four shillings a ton at the pit mouth must surely make it the cheapest coal in the world. Cheap labour, and plenty of it, plus easily-worked seams, supply the cause, notwithstanding the fact that the labour borders on inefficiency. Some people are hoping that a slight rise in wages will




eventually produce a coal-mining caste, and then hey for a new era amongst Indian coolies! As it is, the output is represented by only some 150 tons per miner; six or seven years ago it was under 100. Compare this with the 500 of the American pitman or the 300 of the Britisher; though it should be remembered in making the comparison that there is plenty of room yet in India for the introduction of improved mechanical apparatus. The whole industry is probably on the eve of a great development as certain schemes come into operation for laying down steel-manufacturing plant in the neighbourhood of the Bengal coalfield.

# SUGGESTIONS FROM AMERICAN SCHOOLS.

BY W. H. WINCH, M.A.

(*Continued from page 447.*)

## *CHICAGO, ILLINOIS, ELEMENTARY MIXED SCHOOL.*

GRADE VIII. Forty-two children were present; eighteen were thirteen, seventeen were fourteen, and seven were fifteen years of age.

I was aware that this school possessed a high reputation for its work, and especially for its work in English composition. Its Grade VIII. consisted of four equal classes; from two of these the best pupils were selected to do such work in composition as I should give. This I did without any reference to what had been set previously. I did not doubt that it would appear in the answers if I were unfortunate enough to ask for what had been done before. I gave a choice of three subjects:—

1. A drama. Scene—the neighbourhood of the Rocky Mountains. Time—eighty years ago. Characters—a hunter and some Red Indians. 2. A poem on a daisy. 3. A letter to the Principal, descriptive of Lake Michigan.

The pupils were recommended by the teacher to do whichever they thought was the hardest. We agreed to allow forty minutes for the exercise, but some took rather longer. I was present during the whole time that the work was going on, and the papers were handed in to me individually as soon as they were finished. About one-third of these were selected as excellent, and after some *hours* of comparison I decided on three exercises as the best—one play, one letter, and one poem.

I am careful to give the conditions of production and selection very precisely in this case, because I feel the work to be so high in character that it may be received with some scepticism. And perhaps it is worth mentioning that 85 per cent. of these children had foreign-born parents, who were mostly, I was told, Norwegians and Swedes.

### A NARROW ESCAPE.

Characters: Hunter, tribe of wild Indians.

Scene: Rocky Mountains.

Time: Eighty years ago.

*Hunter.* I see a wild goose. It is mine if it does not fly. So here goes.

[He shoots, and in an instant a tribe of Indians come running toward him.]

*Indians.* Wow, Wow, Hoop, Hoop, White, White.

*Hunter.* Oh mercy on me what have I done. I'll try to amuse them with my compass. [He does.]

*Chief.* Me chief. Me help you. You give me heap much rum, me let you go.

*Indians.* Rum—Huh—Rum.

*Hunter.* I have no rum, but I have money.

*Chief.* Money no good. Me keep you.

[They bind him, hands and feet, and the Indians carry him to their cave.]

*Chief's daughter Wola.* Oh him pretty man. Me no let you kill him.

*Chief.* We not kill him, keep him.

[That night Indians go on a raid. While they are gone Hunter converses with Wola.]

*Hunter.* I'll give you anything I possess if you help me to get free.

*Wola.* Me help you, no to-night.

[That night the hunter sleeps in the tent.]

*Wola* (to herself). Him pretty man. Me no want help him.

*Chief* (next morning). Huh, come hunt.

[Hunter goes out hunting with them. As he had left his horse tied at the foot of the mountain, they provide him with one.]

At the close of the day they come home with much game. The hunter eats no supper, and after the meal the chief smokes a while, then goes to bed. When all is quiet the hunter jumps up and crawls to the door of the tent.

*Hunter* (to himself). All is quiet. I will risk it. The horses are tied in the rear of this tent.

[He unties the horse.] They ford stream and river.

*Hunter.* I hear horses hoofs in back of me. Run my dear horse run.

Leans over and pets horse.

Soon he is at an American camp. The Indians come in time to meet the whites all armed ready for a battle. The Indians are defeated, and flee for their lives.

This makes them very angry and they massacre the whites for many miles around.

AMELIA POLLASCHETS. Age, 13 years.

### A LETTER TO THE PRINCIPAL.

Mr. B——. Dear Sir:—

I take up my pen with pleasure, to inform you of my delightful trip accross the waters of lake Michigan. It's water reflects the azure color of the sky, and is inhabited by various fish. It's waves though not very large, ripple among the rocks on it's shore, and form a rolling surface to the water. The water is pure, and its used for the drinking of the inhabitants of our city. The bluish tint of the water is somthing the pen cannot describe nor can the brush picture it. It is most beautiful. A cool refreshing wind skims its untiring surface. Now and then a fish will come to surface, examine the weather, take a breath of the fresh and plentiful air, and return to its cavernous home at the bottom of the lake. The lake is a little shallow near the shores, but it grows quite deep near it's center. Many boats peirce it's surface as they skim over it in the path of traverse. Yet all apreciate it, even the sea fouls come to drink, of it's waters, like the Pegasis of old sought the fountain of Pirene. Words cannot describe it as I said before. It is within the reach of millions, and welcomes all. It refuses no man a drink, or no ship a smooth passage. It's mirror like surface, reflects the clouds and sun, and at night time the moon's rays form a beautiful picture on it. Having exhausted all my power of describing it,

I close, with regards to all,

LEWIS WEISS. 14 years 1 month.

*P.S.*—I expect to deminish the suply of fish in the lake and have my tackle ready to start early in the morning.

The following poem is, in my judgment, more remarkable than the above letter, when considered as the production of a child in an elementary school.

### THE DAISY.

In the meadows, green and bright,
When the flowers lift their heads
There the daisies, pretty sight,
Make their little beds.

Hers a coat of yellow is,
Proud of it she seems to be,
As from right to left she bows
Nodding prettily.

She is useful, yes indeed,
For she gives, in time of need,
To the bees, her nector sweet
Genorous little deed.

Children coming home from school,
Stop to pick her blossoms sweet
Many homes her blossoms cheer,
Many ill do greet.

Daisy, daisy, stay with us,
Never, I pray you, depart.
Children give thee all the love,
In their little heart.

MARY GILLIES. Age, 13 years.

But perhaps there may be found scattered here and there in English schools some juvenile writers of poetry quite equal to this. I saw some verses a week ago in a boys' school near Mr. Albert Chevalier's boulevard—the Old Kent Road—which quite "knocked" me; but the interesting point is that, in this American school, poetry was made regularly as a class exercise. Let it be understood, however, that the work of the Grade VIII. of this school was quite exceptional—a strong Head, four able women teachers for the four graduating classes, a good class of children, though born of foreign parents, and, for Chicago, a good situation topographically—all combined to produce first-rate work. It was not only the English that was excellent—arithmetic was excellent, too, but the English was quite exceptional; the grammar—lesson, I was going to say, but symposium would be a better word—displayed a knowledge and logical power on the part of the children which I have never heard surpassed in our best classes for pupil teachers.

It would not be quite fair to England to close the account here given of English work in American schools by examples so obviously emanating from a "cracker-jack" (American for exceptionally excellent) school. Let me present some examples which were much more strictly typical.

### *MANHATTAN, NEW YORK STATE, ELEMENTARY SCHOOL FOR BOYS.*

Grade VIII. B. Twenty-nine pupils were present, ranging from twelve to sixteen years of age; the average age, approximately, would be fourteen and a half years at the end of the educational year—the time of graduation—at this date some six weeks distant.

I suggested "New York" and "The Elephant" as subjects for composition; the teacher added "Our District Games." We instructed the boys to make their exercises short and pointed, as barely thirty minutes could be allowed altogether. The boys started off with the usual readiness of American children, and in less than thirty minutes the papers were handed in to me. The teacher and I decided that every mistake in grammar and spelling should be marked, but that the composition should be estimated separately. The school marks for this work were A, B, C, and D. The boys who got C's and D's were never recommended for graduation—that is, they did not receive a "Leaving Certificate," and could not pass to the public High School.

I give below two papers exactly as written. The first was marked "A" both by myself and the teacher; the second was marked "C" by both of us.

#### THE DISTRICT GAMES.

"Last Saturday, May 5, 1906, the schools of the Eighth and Twelfth Districts had their annual Indoor Games. They were held in the Twenty-second Regiment armory and lasted four hours.

"First, there was basket ball, then came some racing; and the armory echoed with the yells of the various schools as they cheered their champions on. In most of these races all the schools except Fifty * were put back for premature starting. The best race was the 880 yard relay. The first runner for our school was second when he finished, but, when the race was finally terminated, Fifty was fifty feet in advance.

"The games ended when the schools had sung their school songs and the 'Star-spangled Banner.'"

#### THE BEAUTY OF NEW YORK.

"The beauty of New York can not easily be imagined by one who never set his eyes anywhere around it.

"One place in New York, if visited, would prove it beauty namely: Central Park. It is the center of the city; it is situated on the Avenue where most of the rich live; it is the favorite park of most people of the city; and it stands out to show the beauty of New York because, government pays so much money to have it kept in this order.

"Nor is there many places as such everywhere; but in New York they are abundant. If there were as many places as these in all parts of the world, people would be very thankful."

The teacher and I, marking off and not on the papers, showed a most remarkable agreement, the point of interest being that I took with me the "pass" standard of a good London school. The shortness of the exercise was a direct consequence of the limitation of time; and we may remember that it is sometimes harder to write a good *short* composition than a good *long* one.

The teacher marked 2 papers A, 19 papers B, and 8 papers C. I gave 5 A's, 16 B's, 7 C's, and 1 D.

There were very few errors in spelling and grammar. Unlike the Chicago boy who wrote so well about Lake Michigan and spelt so badly, only one boy in this class who composed well spelt badly. Grammatical errors were practically non-existent, and the style, clear and pointed, though perhaps a little jerky, necessitated a good mark when we considered the exercises, as of course we did, purely as "composition."

For just one year now, month by month, I have been endeavouring to give the readers of the *Practical Teacher* selections from my American investigations into the teaching of English, which may make clear to them how the American work is done, and how much is done. In their own minds the questions are sure now to arise: Are the American children more proficient in English than ours? and why, if that is the case, is it so?

Each teacher can see for himself, from the examples given, whether the American boys and girls are better, on the whole, than our own. I think they are; and if I were asked for the causes, I should give three. Firstly, the high estimation in which English is held

* Fifty is the name (!) of the school. The name is purposely falsified.

throughout the whole of the American educational system; secondly, the much greater proportion of school time which is given to the subject in America than in England; thirdly, the universal method of instruction by "text-book and recitation" in all subjects.

I think the immediate future in English education will show an increase in the time given to English in all types of schools—yes, even in elementary schools. With all deference to the recent Report of the Poor Law Commissioners, and agreeing as I do that a kind of "vocational" preparation should be aimed at in elementary schools, this will not, I think, be given at the expense of training in the use of English, but at the expense of the "frills and fancies" (I thank America for the expression) which have from time to time encroached upon the true province of the primary school. But whether my forecast be true or false, English will continue the first subject in elementary education; and it will still be of use to us to know how our cousins across the Atlantic prize it and teach it.

## A LITERATURE LESSON.

BY MARY S. JACOB.

STANDARD II. Fifty-four girls were present. The average age was eight and a half years. The story chosen was "The Ugly Duckling," by Hans Christian Andersen.

The method sketched in this short paper is adaptable in the case of stories chosen for the purpose from books in use in the school, and read by the children, or it may be employed by the teacher in connection with a tale told in the classroom. I have chosen the latter.

The teacher first told this story—the supreme masterpiece among Andersen's fairy tales. For strength of aim and delicacy of handling it stands alone as an imperishable witness of his genius.

The fundamental harmony of the narrative starts with the introduction, which describes a vividly typical Dutch landscape. To the children are pictured the brilliant yellow cornfields and the green meadows with the stacks of hay. The stork at once fascinates and claims their attention. This alluring bird is said to be walking about on his "long red legs and chattering Egyptian." The country building is next described to them, "surrounded by deep canals," and the burdocks, which were so high that "little children could stand upright under the loftiest of them."

At this point the listeners readily imagine the Mother Duck—that good-natured, well-meaning, but absolutely preposterous foster-mother.

Then is portrayed the intense pride of the Mother Duck in her charming little family, and her graphic conversation with the homely and versatile old Duck who had come to pay her a friendly visit.

After this a rapid series of adventures—more or less startling—follow in rapid succession. The Ugly Duckling's sad experiences of life are related from the moment when, large and frightful, it timidly creeps from the shell; its introduction to the poultry yard, and the severe persecution which it undergoes there; and then its sad, despairing flight.

Next comes the meeting of the hero with the somewhat flippant wild geese, its education in scenes of death and horror, and its tragic escape. The Ugly Duckling is then introduced into the world of men and women. But it is shown to the children that in this story the animals are the ruling power, and take the leading part. The Ugly Duckling is still looked down upon with scorn, and runs away for the second time. There now follows a short but most picturesque description of spring and the appearance of the flock of swans.

All this was followed with the greatest interest by the children, and the coming of winter, with the sufferings of the most unhappy and unfortunate bird, vividly appealed to their imaginations. The little sketch of the bird's alarm, so brilliant as described by Andersen, was reproduced as nearly as possible by the teacher.

And now returns once more the lovely season of spring, and with it the happy ending of the despised Duckling's troubles. He discovers that he is no longer ugly, but a splendid swan of dazzling beauty; and after the homage of his kind and the adulation of delighted little children the highly satisfactory finale is reached.

Now followed criticism and animated discussion.

"We have finished the story," remarked the teacher. "What part of it did you like the best?"

(Great eagerness and anxiety to answer.)

"I liked the part where the Ugly Duckling was changed into the lovely swan."

"I *loved* it when the egg cracked and the funny little brown bird came out."

"The part I liked best was when the Ugly Duckling was first put into the pond and swimmed best of all."

"I liked the piece about the old woman and 'Sonnie' and the hen best."

It was impossible to hear *all* the suggestions offered. Those made were fairly to the point, and showed a certain amount of intelligence.

"Now tell me what you think of the behaviour of the Ugly Duckling? Do you think he was a good little bird, or was he naughty and self-willed?"

"I think he was very silly and soon terrified," remarked one lusty girl.

"He was a kind duckling not to peck the others back."

"I wish he had been happier when he was littler," observed one merry child.

Here an opportunity was taken by the teacher of drawing the children's attention to the fact that the Ugly Duckling was the youngest of the little family, and should have been protected by the others. It was also impressed upon them that they should never make fun of those who were weaker than themselves or had any physical infirmities.

"Do you think the Ugly Duckling was right in running away from home?" next asked the teacher.

"He should have stayed and made the best of it," remarked the lusty girl.

"He was 'afeared' for his life, and it would have been a pity to have been killed!"

"I think he was right, because they wasn't his 'real' brothers and sisters!"

"It's no good to be miserable!" observed the merry girl.

The teacher here told the children that if the Duckling had been older he might have braved it out; but as *all* the ducklings and the whole poultry yard seemed against him, his only safety lay in flight, and that under the circumstances he did not play the coward's part.

Time was now flying, and the teacher gave the

children a few minutes to ask any questions or make any criticisms which suggested themselves.

Amongst those made were the following :—

"Don't you think that the cat and the dog thought a lot of themselves ?"

"Yes. They were evidently much petted, and certainly thought a great deal of their own opinions."

"Why wasn't the Duckling frozen to death when the water was all ice and snow ?"

"The Duckling had warm feathers, and besides that its natural oil kept it from freezing."

"I feel very cross with the old Mother Duck not to have punished the little ones for being rude to the Ugly Duckling."

"Yes. She certainly ought not to have allowed them to be so cruel and disagreeable."

"I hope the duck came back when it was a swan and showed them he was more beautifuller than they was."

The teacher explained that history did not answer that problem, but that she felt quite sure that if he did so he would be very kind and forgiving and not at all proud.

Here the bell rang for dismissal. The children reluctantly went home. On the next day the teacher briefly revised the tale, and arranged it under suitable headings. Great care was taken in doing this, as it is always found necessary when narrating a story to get a definite and clear outline of events before filling in the detail.

The children were now invited to relate it themselves. Many did so with evident appreciation. The thread of the narrative was kept very fairly even

THE UGLY DUCKLING COMING OUT OF ITS SHELL.

throughout. Being a school for children mostly of the slum class, it was necessary to keep a most careful watch upon the expressions used, and lapses into colloquialisms and grammatical errors were carefully corrected.

The next lesson being that of drawing, each child did an imaginative picture of that part of the story which appealed to its particular fancy. The old woman, "Sonnie," and the hen, needless to relate, figured in a conspicuous manner. I give one drawing above, with apologies for the perspective !

*Note.*—As the result of experiment in this direction I have found it best to revise and group the story on the day *following* its narration. Criticisms and suggestions are best obtained directly after the *first recital* by the teacher, when the impressions of the tale *as a whole* are most vivid, and there has been no time for preconceived thought and interchange of opinion amongst the scholars.

It has also been found an excellent plan to copy the "headings" of the story into special books kept for that purpose. These are useful for reference. Occasionally—in the upper classes—a criticism made by the individual child is appended. The book becomes a valuable possession, and ought to recall in after days many lessons learnt in the classroom.

The dictation of stories I have found very laborious, and only possible with the elder scholars.

## A NATURE READING.

### THE GARDEN SPIDER.

*Reprinted by kind permission of Messrs. T. C. and E. C. Jack from "Dwellers in the Garden," by the Rev. Theodore Wood.* (*See page* 551 *for review of the "Dwellers" Series.*—ED.)

NOW I want you to come and look at this big spider's web.

There is the spider which spun it, you see, resting in the middle. We cannot say that she is head downwards, because spiders have no heads ; but she is upside down. And if you look closely at her you will see that she has a white cross upon her back. For this reason she is often called the "cross spider." But generally she is known as the "garden spider," because there is hardly a single garden in any part of the country in which her web is not to be seen.

Would you like to know how she spins this web ?

Very well, I will try to tell you.

She sets to work very early in the morning, long before sunrise ; and first of all she spins a sort of outer framework, which she fastens firmly in position by means of a number of silken guy-ropes. And always before she fixes a thread in position she gives it two or three small pulls, just to make quite sure that it is sufficiently strong. When this framework is finished she carries a thread right across the middle, from one side to the other. Then, always starting from the centre of this thread, she carries a number of other threads to the margin, working all the way round it. So that by the time this part of her task is completed, her web looks very much like a badly-shaped wheel.

The next thing that she does is to spin a little silken platform in the middle of the web to sit upon. And when this is finished she starts from the middle and spins what we call the "spiral thread," working round and round and round, and fastening it carefully down every time that it crosses one of the straight threads, which look so much like the spokes of a wheel. And in about three-quarters of an hour the web is ready for use, and she goes to her little platform to wait for some insect to fly into it.

But what is the silk made of ? And how does the spinner manage to spin it ?

Well, as long as the silk remains inside the spider's body it is not thread at all. It is a kind of thick gum, which is contained in six long slender tubes just inside the hinder part of her body. Now just look through this magnifying glass at the tip of the spider's tail. Do you see six little projections arranged in a sort of cluster ? We call these "spinnerets ;" and if you were to look at one of them through a good strong microscope, you would see that it is pierced by hundreds and hundreds of tiny holes. Now, each of the silk tubes opens into one of these spinnerets, and when the spider wants to spin her line she squeezes a drop of silk into a spinneret, touches the object to which the line is to be fastened, and draws her body away. As she does so, a very slender thread comes out from each of the tiny holes, and all these threads join together into one strong cord.

So you see a spider's line is made up of hundreds of slender threads all bound up in one, just like our own ropes. And if a spider wants to spin a very strong line indeed, she can use two or three or even more of her spinnerets at the same time, so that all the thou-

sands of threads which come from them are fastened together into one stout cord.

But what makes the web sticky?

Well, if you were to look at a little piece of the spiral thread through a strong microscope you would very soon see. For the thread is thickly covered with tiny drops of liquid gum. These drops are so very small that there are nearly two hundred of them in every inch of thread, and seventy or eighty thousand in a large web; and after about twenty-four hours they dry up. So every day, when the weather is fine, the spider has to cut down her old web, and spin a new one in its place.

But how is it that the spider does not stick to her own web as the flies do? Well, the reason is that only the spiral thread is sticky. The straight threads have no gum upon them at all, and when the spider runs about on her web she takes great care to put her feet only on the straight threads and never on the spiral one.

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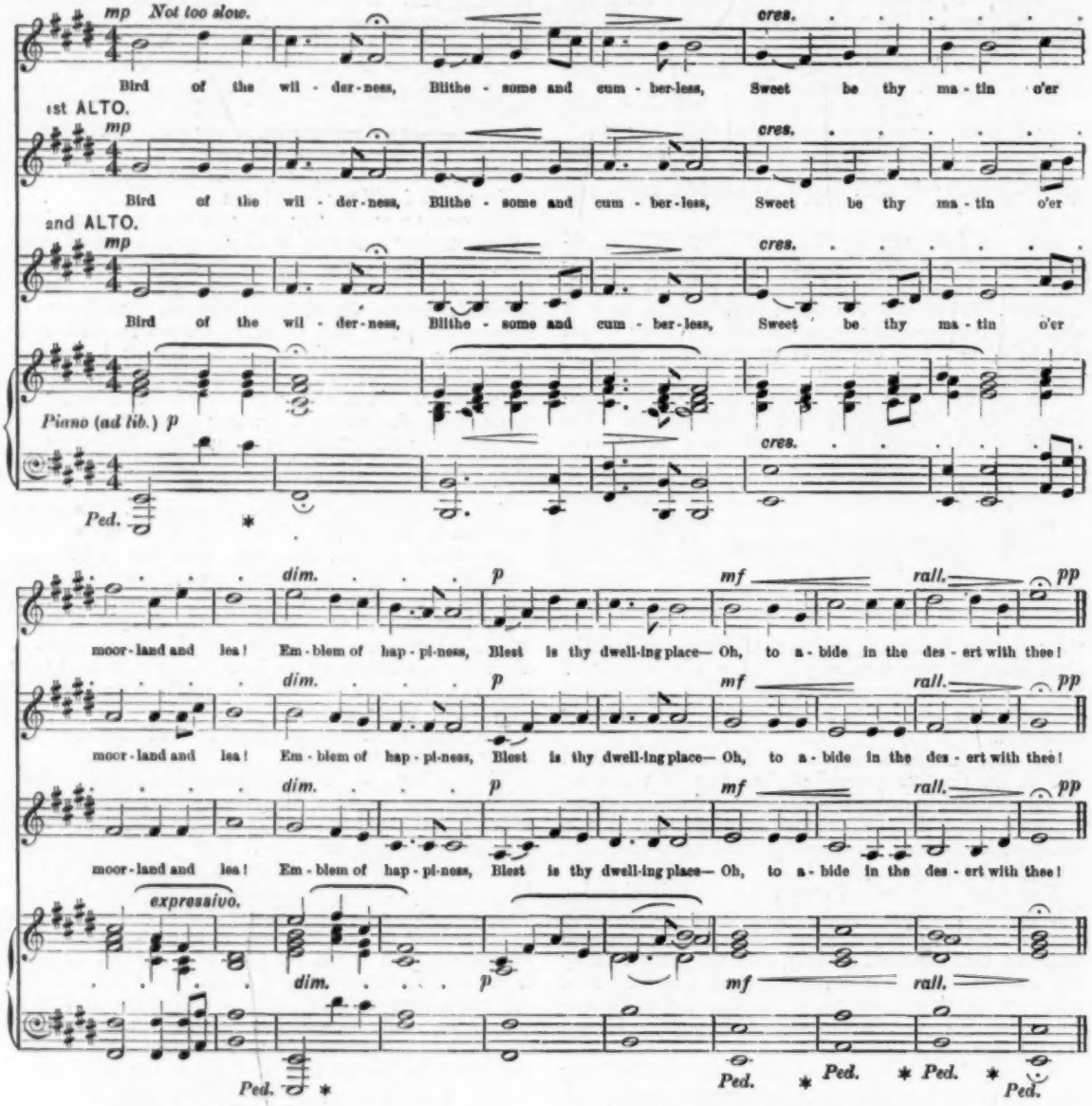
## THE SKYLARK.

*Words by* JAMES HOGG. *Music by* C. E. PARKINSON.

mp Not too slow.
cres.
Bird of the wil - der - ness, Blithe - some and cum - ber - less, Sweet be thy ma - tin o'er
1st ALTO.
2nd ALTO.
Piano (ad lib.) p
Ped.
dim.
p
mf
rall.
pp
moor - land and lea! Em - blem of hap - pi - ness, Blest is thy dwell - ing place— Oh, to a - bide in the des - ert with thee!
expressivo.

1. Bird of the wilderness,
Blithesome and cumberless,
Sweet be thy matin o'er moorland and lea!
Emblem of happiness,
Blest is thy dwelling-place—
Oh, to abide in the desert with thee!

2. Then, when the gloaming comes,
Low, in the heather blooms,
Sweet will thy welcome and bed of love be!
Emblem of happiness,
Blest is thy dwelling-place—
Oh, to abide in the desert with thee!

# Our Art and Handwork Section.

## PAINTERS AND PICTURES

BY W. E. SPARKES.

### III.—FORD MADOX BROWN. IV.—SIR J. E. MILLAIS, P.R.A.

FORD MADOX BROWN and Sir J. E. Millais were closely associated with the pre-Raphaelite movement, which did so much to vivify British art. Evidence from letters and diaries written at the time (1850) would seem to point to Holman Hunt and Millais as the real originators of the Brotherhood—Brown assisting them to formulate their ideas, and Rossetti, in his brilliant way, adding just the touch of poetry that would appeal to the literary rather than the artistic mind.

The pre-Raphaelites have played their parts and made way to other actors on the scene, but they have left traditions which could not, without peril, be thrown hastily aside. Perhaps, after all, they only brought out the old weapons, furbished them, and gave them the appearance of new; for, stated in so many words, the Brotherhood called attention to what had been the practice in all great schools in the past.

Early Victorian art had become trivial and commonplace. The artists repeated themselves almost by formula; they had little originality, but they ransacked Shakespeare, Milton, Spenser, and Chaucer for their subjects. In fact, the art was anecdotal and spectacular. Those were grand times for the theatrical costumier; for if the artists had no touch of poetry they had a keen eye for the value of properties, for silks, satins, tinsel, and Wardour Street antiquities. They affected lively and humorous subjects, which they treated often with the lugubrious air of the "heavy father" on the stage. It was all highly respectable:

CROMWELL DICTATING DISPATCHES TO MILTON. (FORD MADOX BROWN.)
*(By permission of the Manchester Corporation.)*

it required no thought on the part of the public: the colours were brilliant, and though, as Holman Hunt once asserted, the faces in these pictures were of the consistency of wax, there was an attempt at delineating character not always successful, mostly theatrical, but passable at a pinch.

But that wave of serious thought, which, passing over the England of 1840 and onwards, changed the course of all the streams of intellectual life, and brought about Oxford tracts, Gothic architecture, and new tendencies in poetry, sent its impulses throbbing into the placid waters of current art.

No change comes about painlessly. The studios whence humdrum pictures were sent, year in year out, to all the exhibitions suddenly received a shock. Some pestilent fellows in London were creating a disturbance that threatened to develop into a riot. They were proclaiming in all the highways a coming revolution which should put down from their seats of honour those comfortable artists who had held unquestioned sway for so many years. Rumours of change and rumblings that approached nearer day by day had already come from the Continent, where political unrest had been followed by reaction in art. France, Belgium, and Germany had all alike joined the movement, and when the storm burst in England it was not entirely unexpected.

Ford Madox Brown, always a stormy petrel, had returned from Bruges a short time before, bringing with him warnings of the coming disturbance of easy use and wont; and before long the movement began to spread in rapid circles. At first a picture here and there appeared on the walls, challenging all the established canons of British art. At once the alarmed Royal Academicians rose with a shout to smite the accursed thing; for not only had these new artists dared to treat them with contempt, but they had the boldness to enter on an active campaign against them and all their works.

The air suddenly became electric. Indignant letters to the *Times* were followed by defence and recrimination. The new men, instead of bowing to constituted authority, bound themselves together in a band, and put on all their pictures the mystic "P.R.B.," which at once proclaimed their faith and was a challenge to combat.

It was then that Ruskin stepped into the ring, took up the cudgels, and administered such vigorous knocks that the "P.R.B."—the Pre-Raphaelite Brotherhood—found themselves on the winning side. His eloquence, his apt illustration, and his enthusiasm for the new art gradually wore down opposition, and obtained a fair field and no favour for the Brotherhood, who were left free to show of what stuff they were made, and to conquer or fall in defeat according to their deserts.

The movement has passed, but it profoundly affected British art. Ford Madox Brown refused to join the Brotherhood, being indeed always an independent and somewhat angular man, though his influence was strongly felt. To mention one fact among many—he taught Rossetti to paint, and Rossetti taught Burne-Jones.

And what, after all, did the Brotherhood teach so foreign to art as to rouse such opposition?

Their marching orders have been written down for us by William Rossetti, brother to the artist, and one deeply in sympathy with the movement. They are simple enough in all conscience, and one wonders why they should have caused such a pother.

They state that the artist should have genuine ideas to express; that he should study Nature closely, so as to know how to express these ideas; that he should train himself to sympathise with what is serious and heartfelt in previous art, and not merely the conventional and clever; and lastly, that he should produce thoroughly good work.

Nothing very revolutionary in all this! But the Brotherhood went on to say that all serious and heartfelt work in art ceased with Raphael. Since his day the world had been flooded with clever paintings, empty of thought and feeling, parading themselves for applause; and, as a natural consequence, all men in earnest should turn their thoughts to the serious artists before Raphael, and endeavour to catch the spirit which shines through their slightest work.

For those were the days when men loved Nature so devotedly that they could not neglect a single flower: they painted the petals and even the blades of grass; the pattern on an angel's robe was minutely drawn, as if to be used as a design in future ages. But, above all, those ancient Italian artists endeavoured to paint the souls of men and their passions.

And, therefore, these new pre-Raphaelites—Rossetti, Holman Hunt, Millais—painted minutely; they selected intense moments of passion, careless whether their subjects were drawn from the Bible, from ancient poetry, from history, or from modern life. It was a revolt against the unreal and sentimental; a cry to arms for a struggle to make art a live and active force.

And in considering their work one is always struck by this minute care, as well as by the concentrated thought which makes even the accessories in the picture play their part.

### "Cromwell Dictating Dispatches to Milton."
(By Ford Madox Brown.)

Nothing is more effective than contrast in a picture. It is a device continually used: contrast in lines, curved lines among straight; contrast in colour; contrast in tones, the light and dark approaching each other for effect; contrast in action, active and passive opposed; contrast in character of faces.

Ford Madox Brown takes this as his keynote in the present picture. On the table lies a map of Southern Europe, and the Protector's finger is placed fiercely upon the Alps, among whose valleys are living the Protestant Vaudois. At that time (1655) Cromwell had dreamt of an alliance between the Protestant nations of Europe against Catholic France and Spain, a dream destined to come to nought, since rivalry in trade effectively set Holland and England at variance, while France and Spain were at bitter enmity. Cromwell, however, had thrown in his lot with France, as being less bigoted than Spain. This alliance was strengthened when the Duke of Savoy began persecuting his Protestant subjects, the Vaudois, living in the Alpine valleys, on whose behalf Mazarin, the able minister of Louis XIV., had interfered. There could no longer be any hesitation on Cromwell's part. He backed up Mazarin, sending threatening dispatches at the same time to the Duke of Savoy.

The moment chosen by the artist is that in which Cromwell, having received an appeal from the Vaudois, hurries impetuously, booted and spurred, to his secretary to dictate a fierce warning to the Spaniards. Milton, less energetically but none the less deeply moved by

the news, translates Cromwell's rugged English into scholarly but biting Latin, which his Puritan clerk writes, his eager face betraying his sympathy with his chief's emotion.

How deeply Milton was moved by the outrage is shown in his sublime sonnet, "On the late Massacre in Piedmont."

"The Boyhood of Sir Walter Raleigh." (Sir J. E. Millais, P.R.A.)

"Avenge, O Lord, thy slaughtered saints, whose bones
Lie scattered on the Alpine mountains cold!
Even them who kept thy truth so pure of old,
When all our fathers worshipped stocks and stones,
Forget not: in Thy book record their groans
Who were Thy sheep, and in their ancient fold
Slain by the bloody Piedmontese that rolled
Mother with infant down the rocks. Their moans
The vales redoubled to the hills, and they
To Heaven. Their martyred blood and ashes sow
O'er all the Italian fields, where still doth sway
The triple tyrant; that from these may grow
A hundred fold, who, having learned Thy way,
Early may fly the Babylonian woe."

The artist could hardly have selected a scene more crowded with intense emotion than this, in which the rough Protector and the cultured scholar indignantly act in concert.

What admirable contrasts are here to give point to the artist's intention! The burly, impetuous Cromwell, dressed as a soldier and seated roughly on the table, every particular emphasising his emotion—the forward thrust of his head, the anger shown in his face, his strong hands awkward but energetic; while opposed to him is the quiet scholar, with refined hands in easy motion, his handsome face expressing suppressed emotion.

Even the accessories play their part. Cromwell's armour, the cold marble background throwing his rough head in relief, are proper to the man; while Milton's love for music (reflected in his melodious verse, and breaking out continually in his praise of "divine sounds" and "harmonious noise"), is suggested by the organ against which he leans; to which the artist adds such touches as the inlaid wreath of laurel on the cover of the keyboard crowning the poet halo-wise. Even the roses at his feet have their meaning, for his tremendous vision of heaven and hell did not leave him insensible to fruits and flowers, nor to

"The flowery May, who from her green lap throws
The yellow cowslip and the pale primrose."

And the little window with its glimpse of the sky is not only a device, common to artists, for carrying the thoughts from a close interior, but its sunset colours have a reference to his Paradise and heavenly vision.

Milton, in fact, rather than Cromwell, is the chief actor in the scene. He is isolated by his surroundings; both the Protector and the clerk look towards him; the striking lines in the map, the table, and the fireplace converge to draw the eye inevitably in his direction.

No painting could be a better example of the pre-

Raphaelite creed. There are intensity of emotion, fine drawing, brilliant colour, suggestiveness in detail. Beside such a picture the Malvolios, Sancho Panzas, and Toby Belches—the showmen and muffin-men so dear to mid-Victorian art—make but a poor show.

"The Boyhood of Sir Walter Raleigh."

(Sir J. E. Millais, P.R.A.)

Although, by all accounts, Millais, together with Holman Hunt, appears to have been the prime actor in the pre-Raphaelite movement, he afterwards changed his views, much to Ruskin's indignation. At first, in his precocious boyhood, when he was winning medals at the Royal Academy schools as a mere child in tunic and strap-shoes, he painted in academic fashion. Then followed his connection with the Brotherhood, in which he gave and took many hard knocks; and then he threw aside the minute care for particulars, painted in a broad style, and enwrapped his figures with atmosphere—in this last and final change definitely breaking with the pre-Raphaelites. For perhaps the most serious and well-sustained charges against the school were that it made too much of outline, and ignored the effects of atmosphere. In the National Gallery two pictures are placed side by side in illustration of his periods: these are "Ophelia" and "The Martyrdom of Saint Stephen." In the "Ophelia" he painted every thread in the gold-embroidered dress, each individual flower floating down the stream, every blade and every leaf growing on the bank. One needs a magnifying glass to trace the tiny strokes that enrich the elaborate design. And, moreover, the colour is brilliant throughout, so that, seen from a distance, the canvas lights up like a polished stone. But in "The Martyrdom of Saint Stephen" all this is altered. Outlines are lost, minute handling makes way for breadth, the colours are subdued, thin veils of air surround the figures and trees alike.

Yet Millais maintained much that he had learnt in his pre-Raphaelite days; and among these he never ceased to employ parable and suggestion in the accessories.

"The Boyhood of Sir Walter Raleigh" belongs to his later years. In this his strong colour once more appears.

A foreign sailor, bronzed with travelling in tropical seas, sits on a log behind a sea-wall. He wears a white shirt and red breeches. The boy, with his hands clasped about his knees, is dressed in green; the other boy is in black velvet. Touches of brilliant colour in the plumage of the birds lying on the log keep up the high-pitched tune, while the blue sea harmonises with the colours in the dresses.

The scheme in Ford Madox Brown's Milton is largely followed in this picture. There are three figures—one in energetic movement, the others placid and inert. The principal figure (young Raleigh) is seated to the left, and all the leading lines—the sailor's left arm, the log, the sea-wall, the spars of the toy-boat lying on the left—lead towards him.

Millais has been compared to the great Spanish painter Velasquez—that is to say, he was a superb painter of men and women. Following his instincts, the instincts of all fine portrait-painters, he seized upon those characteristics most obvious in his sitter, and, perhaps unconsciously, in following the model before him, he struck a note that revealed character. Every one who remembers Velasquez's "Pope Innocent X." wonders how the artist dared paint such an uncompromising portrait. No wonder Hazlitt confessed that he would be afraid to sit in the room with such paintings. Millais' portraits have hardly been surpassed in British art. He painted the souls of men; their character is revealed in its nobility or poverty.

But there is another side to the shield. Every fine artist projects his own character and temperament in his paintings. The stern, independent man, such as Ford Madox Brown, stands out clearly in his massive drawing and firm lines; Millais' kindly and sunny nature breaks out like the light in his more suave handling, and in the types he selected in human and inanimate things. In his women and children especially there is a wistful refinement that shows not merely in the face, but in the disposition of the hands and even in the clothing. He projected his own nature inevitably in his work. The two boys in this picture illustrate this completely.

And how richly he uses parable and suggestion. The foreign sailor recalls the Spanish Main. He points to the west, and fills the imagination of the boys with stories of adventures in that wide ocean washing the strange shores which border countries where men, birds, and beasts take on fabulous forms. On the log lie the tropical birds brought from those far shores, and their gay plumage is repeated in the feathered crown once worn by some American Indian encountered in his adventurous quest.

The toy boat, with which the boys have taken imaginary voyages, lies among the stones—an apt suggestion of the perilous rocks to be encountered in the Spanish Main.

In comparing Ford Madox Brown and Millais, and while showing how much they had in common, so far as composition and parable may go, it is important to note that their differing temperaments caused them to paint historical pictures with a difference. Even in Millais' villains—if that word may be used—there is a softening down of character quite foreign to the blunt intensity of the other painter. The murderers of Saint Stephen have nothing repulsive in them; but Brown's Judas Iscariot (like Voltaire's Habakkuk) would be capable of anything. True, in his younger days, Millais made more of this melodramatic action, as, for instance, in his "Lorenzo and Isabella," where the rough guest, kicking a hound, is said to represent the brutal student who had terrified young Millais at the Academy schools, and who lives here, pilloried for ever.

And even in a man he admired, Ford Madox Brown presents Cromwell as uncompromisingly as the Protector would have himself painted by Lely—"to have his picture painted like, roughnesses and everything"—a very trying commission for that prim personage.

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*Practical Polishing, Staining, Etc., for Woodwork.* (*Office of "The Woodworker."*) 6*d*.

Much more in the way of finish may with advantage often be added to the models done in the manual training-room by staining or polishing. This not only enhances the look of the work, but also preserves the wood. Those who desire to know the whole processes cannot do better than buy this cheap little handbook. The necessary information is given in a clear, concise way, so that errors are almost impossible. We can recommend it with every confidence.

# DRAWING IN PUBLIC ELEMENTARY SCHOOLS.

## I.—GROVE ACADEMY, BROUGHTY FERRY.

BY W. RYLE SMITH.

### Junior Division.—Part II.

THE drawing of common objects was referred to at some length in the first part of this article, and illustrations were shown of exercises done on white paper. Reference has again to be made to this part of the work, but the "objects" are drawn on brown paper with crayons. The children are encouraged to bring their toys, many of which prove to be capital exercises in drawing and colour; and the enthusiasm and delight with which the children enter into this kind of exercise has a value of its own as compared with the drawing of ordinary "objects." The colour of the toy is often good though strong, and its simplicity appeals to them at this age in a way in which more subtle tones could not, and comes more within their powers of reproduction. No restraint in regard to *strength* of colour is put upon the children, consequently bright but at the same time more or less harmonious results are obtained.

It is an advantage to the teacher to have a day set aside for a certain kind of toy; so one day is devoted to boats, another to dolls' houses, a third to guns and pistols, etc. By this method the teacher is able to direct more efficiently than if a miscellaneous lot of toys were taken, although very occasionally this is allowed. Plate I., Nos. 1, 3, 5, 6, 7, and 11, are the work of Standard I. pupils, No. 10 of a Standard III. pupil, and are worked out in reds, blues, and yellows.

Memory drawing is a favourite exercise with the children, and is done chiefly on blackboards. Each child is allotted a space five feet long and from three feet to four feet broad, and the subject chosen is generally some well-known building or other object in the district, such as Broughty Castle or Tay Bridge, with the general features of which the child is familiar. As these drawings occupy a few days' lessons, the child studies the object from day to day in order to verify or correct his drawing. In the case of a sea-piece, the teacher indicates the level of the horizon, and a stretch of blackboard twenty feet long or so is given over to three or four pupils to fill; each child then draws the kind of craft that he or she has a fancy for, combining the whole in one picture.

The amount of knowledge of detail displayed by the children in these drawings is surprising, and shows that their efforts in this direction stimulate their general intelligence and powers of observation, and at the same time cultivate their sense of proportion and their ideas of perspective. Plate II. is drawn by a Standard I. pupil; Plate III. is part of a sea-piece by Standard II. pupils. The child who drew the steamer was asked why he had made the stern-mast taller than the fore-mast. He replied that it was a cruiser, and fitted with the Marconigram apparatus. Drawings such as these give rise in the class to questions of detail of construction, and the pupils consequently gain much useful information outside the ordinary routine. Plate IV. is also by a Standard II. boy, and is part of a combined picture; the engine is one of the new type on the Highland Railway. The landscape in this illustration was drawn by the same child, the teacher directing him as to what he should represent.

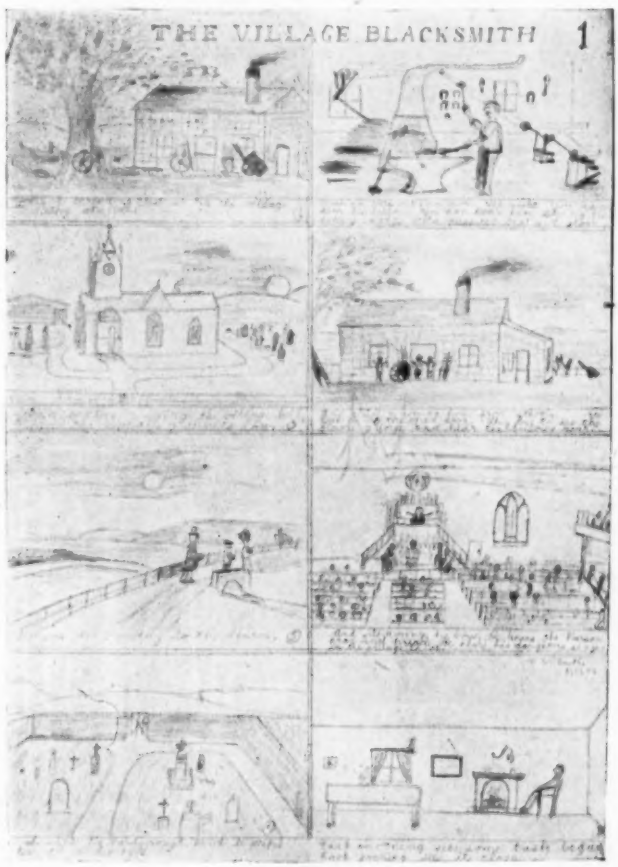



Plate VI.

Plate V. shows a whaling-ship steaming down the Tay on its way to Greenland; the little town of Tayport is seen just over the stern of the vessel. This is the work of two Standard III. boys. Three specimens of memory drawing on paper are shown on Plate I. No. 2 is from a Standard III. child, No. 4 from one in Standard II., and No. 8 from another in Standard I.

Imaginative drawing is closely allied to memory drawing in this respect, that the child as a rule draws something which he or she has seen at some time or other; but as the drawing does not represent a particular existing thing, the child is called on to arrange and fill in details from its own store of ideas. This is a difficult task for the child at first, and the attempts

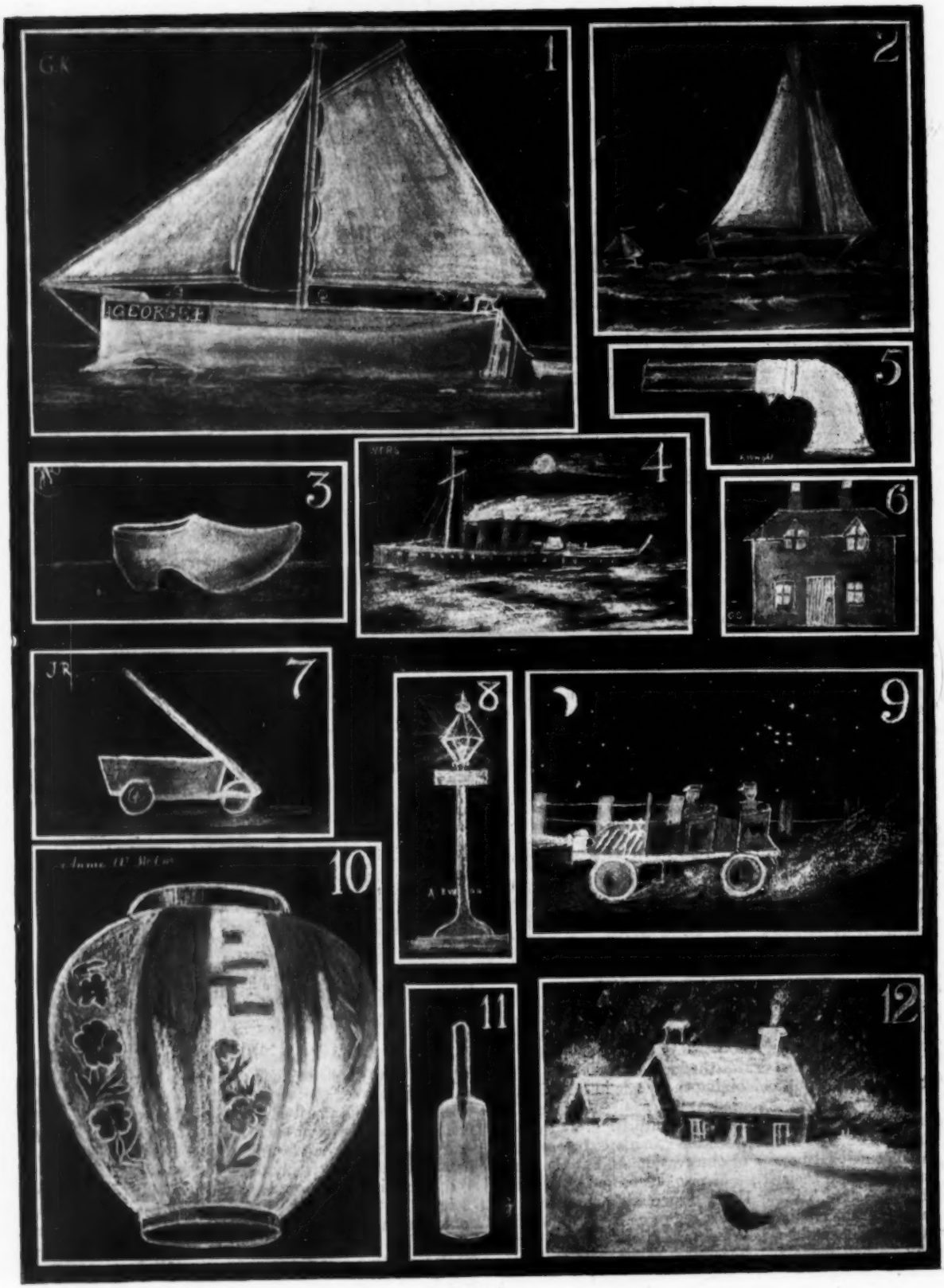



PLATE I.

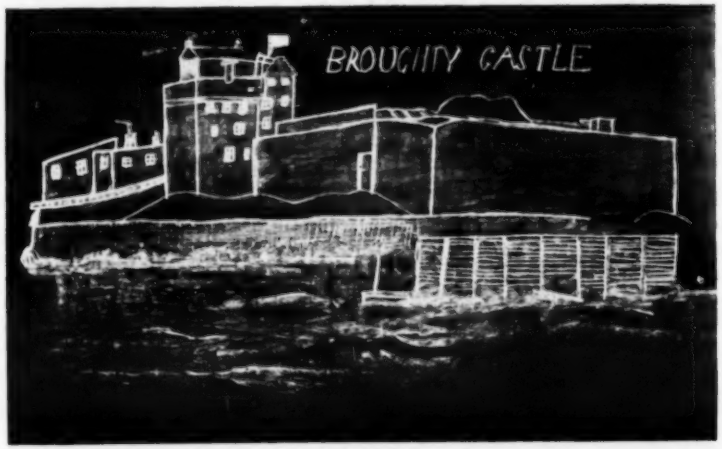



PLATE II.

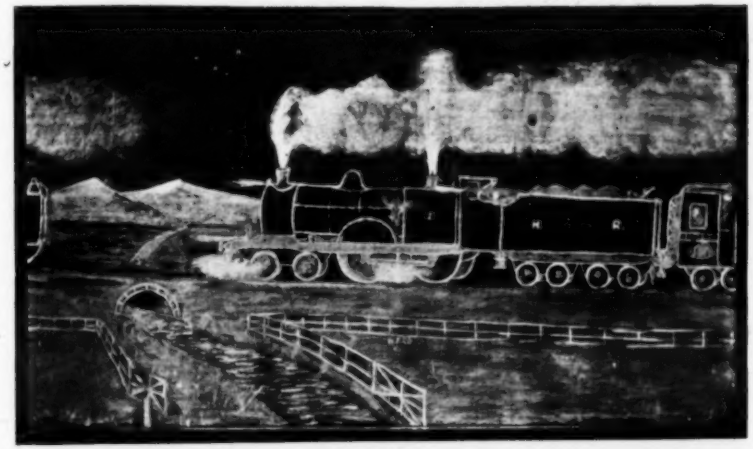


PLATE IV.

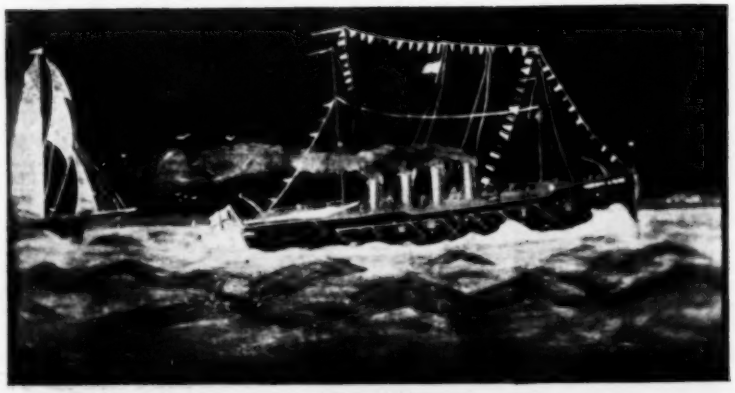


PLATE III.

PLATE V.

PLATE VII.

are very crude; but the effort to express itself in pictures as in words is invaluable as an educative force, and every encouragement is given to this part of the work. With practice the ideas multiply and enlarge, and the ability to express them gradually becomes easier, just as in the telling of a story or the writing a composition exercise. Plate VI. shows a series of drawings illustrating the "Village Blacksmith" by a Standard II. pupil. The teacher's method in preparation for the illustration of a poem in this manner is as follows:—

The poem is gone over carefully by teacher and pupil, questions are put, and explanations given. The children then commit the verses to memory. When the meaning has been grasped as fully as possible, incidents are then selected for illustration, the teacher often being consulted before a start is made to the *pictures*. The teacher makes no suggestion by blackboard sketches, but merely advises. Not all of the class attempt this kind of work, but about half of the pupils have ideas they wish to express.

The modelling in clay in the junior department takes less the form of play than in the younger classes, and sprays of flowers and simple objects are attempted. Backgrounds for the sprays of mistletoe and laurel (Plate VII.) are prepared by putting a thin coating of plasticine on straw-boards; the whole can be easily scraped off when done with. All the examples, with the exception of the apple, are in plasticine, red or gray; but we find that ordinary modelling clay is more suitable for the building up of such mass subjects as the boats shown.

## THE EDUCATIONAL HANDWORK ASSOCIATION.

### LONDON BRANCH.

LECTURE BY DR. KIMMINS, M.A., D.Sc., ON "PRACTICAL WORK IN SCHOOLS."

THE annual meeting of the London Branch of the Educational Handwork Association was held on Saturday, February 13, at the Norbury Institute, Pembridge Square, W., when Mrs. Walter Ward held an "At Home," and entertained members and friends with the open-handed generosity which provides such a unique opportunity for teachers and patrons to unite in furthering the objects of the Association. Mr. Watts, in proposing the re-election of Dr. Kimmins as president for the ensuing year, said that he had been asked why the London Branch was so successful in its meetings during the year, and how it was that they could attract such crowded audiences. In his opinion there was but one reason, and that was, because Dr. Kimmins was the president. Not only was their distinguished president in a unique position to aid the cause they all had at heart in consequence of his official connection with the London County Council and its educational system, but it was through the influence of Dr. Kimmins that eminent lecturers had given their services, and thus attracted not only the interested audiences which they had seen during the past year, but drew the attention of the public to the importance of motor training.

Dr. Kimmins, in opening his address, said that he was so deeply interested in the work of the Association that he would continue—at any rate for the coming year—to act as their president.

He would direct their attention to the fact that there was increased interest shown by Educational Authorities in manual work, and particularly in work which might be done by children in the lower standards. As an instance of this greater interest, he would mention that there was at the present time a Committee of Inquiry sitting at the Board of Education Offices from which they hoped great things. Moreover, the London County Council intended to hold a Conference on the subject of Educational Handwork, to consider the serious gap which undoubtedly existed between the work done in the infant school and that done in the manual training centres. It might well be that the whole question of manual training would be overhauled; for there were some who held that the present system, which had produced such good work in the past, was possibly not the very best that could be devised, and that the time was ripe for further developments.

With reference to the very successful lectures given under the auspices of the Association during the year, he might mention that the very lucid lecture by Dr. Thomas had been repeated by special request before the inspectors of the London County Council schools, and was followed by a very fruitful discussion.

One very important object in providing these lectures was to place the work on a scientific basis. We should come to grief terribly both in this and in other educational questions if we did not examine thoroughly into the scientific principles which lie at their bases. There had recently been some very earnest discussions in connection with the Headmasters' Association on the vexed question of whether or not too much time was devoted to the study of Greek; and it was noticeable that the supporters of the study of Greek as an essential part of a liberal education based their adherence to the time-honoured system on the ground that the study of Greek literature cultivated certain faculties

of the mind to a degree that perhaps no other branch of study could claim: it was represented as a sort of mental gymnastics, which strengthened the mind. Now this was remarkable, because psychologists said that there was no such thing as a faculty, or that if it existed it could not be cultivated.

He deprecated the fact that school teachers would not, as a rule, study psychology. To him it was a most fascinating subject; but he thought that perhaps psychologists were a little to blame in the matter, for they dressed up in a very dull way what was really a most delightful subject of study.

It was a remarkable thing that many whose minds had been severely and thoroughly trained in habits of reasoning, such as mathematicians, were nevertheless sometimes the most stupid of men. On certain definite lines they could reason admirably, but not in other subjects outside the lines of their special study. It was claimed that practical experimental science cultivated observation and improved the reasoning powers, and produced a vivid interest in the minds of the pupils.

He had heard of an amusing incident which happened just outside the hall where a meeting of the British Association was being held. Three most distinguished men of science, men thoroughly trained all their lives in scientific observation, were deeply engaged in a learned discussion, when a fourth man, quite an ordinary person with no trained faculty of observation, came quietly up and picked up a shilling which lay at their very feet.

His advice to enthusiasts was this: "Don't make extravagant claims for your own special subject—claims that cannot really be fulfilled; don't push your theories too far." He knew of certain classes of lads who were specially trained in the observation of minute differences in the lengths of short lines, the claim being that it was an excellent mental exercise. At first their power of comparison was small, but by continuous practice they were able to distinguish very accurately the differences in length between any two given lines. As many as 90 per cent. of the class could estimate these lengths within a limit of five millimetres. When this stage had been reached much longer lines were given them, and it was then found that all this rigid training with short lines had made them *no better* in their judgment of lengths than boys who had no preliminary training at all.

It was of great importance to follow the lines of development of the child. He had been greatly astonished when visiting various infant schools at the power of observation of the children at certain ages and in certain directions. In Nature study, if we systematically cultivated the power of observation between the ages of four and ten, he thought that remarkable results might follow.

He had tested this with a small boy of his own, whom he had set to draw just when his restlessness threatened to become a nuisance. In ten minutes he had drawn a very fair representation of the lecturer reading a book.

He could not say that the features were remarkable for their accuracy, but the relative positions of the head, the chair, and the book were fairly correct, and showed great natural power of observation. He thought that possibly this power might cease for a time when the child became self-conscious and endeavoured to criticise his own work.

In concluding his lecture, Dr. Kimmins referred to the importance of bringing about a union with the National Association of Manual Training Teachers. They were both engaged in very much the same work—they were both striving to educate the public in the matter of educational handwork—and he thought that they would be much more successful if a union could be formed between the two bodies. He suggested that they should send a representation to the General Council recommending that a conference be held on the subject.

Mr. Holman, His Majesty's Inspector for the Wandsworth district, in proposing a vote of thanks to the president, heartily concurred with Dr. Kimmins in the danger of zeal in any cause without the necessary qualifying discretion. He remarked that zeal without knowledge was wicked, that zeal with a little knowledge was dangerous, and that zeal with average knowledge was good, while zeal with special knowledge was splendid. It was necessary to keep a level mind in all things. The chairman had been rather hard on psychologists, but they must remember that most psychologists were not teachers. There was certainly a great gap between the eminent medical man and the teacher, also between the great scientific man and the teacher, but the most valuable results might accrue if we could get a combination of psychology and teaching. It was undoubtedly the fact that in future education must be more real. Manual training must not in the future be a luxury tacked on to our bookish system; we must begin our system of education, not on the basis of A B C, but on the basis of a piece of wood.

In the discussion which followed there was a strong desire shown for getting closer together. The work done by both associations was undoubtedly similar, and their aims were the same. Ultimately it was carried unanimously that the suggestions brought forward by the president should be forwarded to the General Committee—namely, that a small committee be formed to find some common ground of action between the two associations.

Mrs. Ward was also very heartily thanked for her kind and generous reception of the members. In acknowledging the vote of thanks, Mrs. Ward replied in her usual optimistic and happy style. She was on the committee that years ago attempted to promote union between the two Associations, but she had a very bad memory for names, and really could not say who was responsible for past failures. But she wished that all members would also have bad memories for the past, and would put aside all feelings of animosity. There was now a new generation of members who did not inherit the prejudices of the past. Full of enthusiasm herself, though now she was in a sort of educational backwater, she thoroughly believed in the force of enthusiasm to push forward any great movement. It was enthusiasm for the objects of the Association that had enabled her in the past to travel two hours to get to a meeting—the meeting lasted an hour, and then she had the two hours' return journey—but no great movement could be successful unless somebody made sacrifices. They must show the Education Authorities that they were in deadly earnest, as earnest as the suffragists, of which great movement she was proud to own herself a supporter, and of whose ultimate success she had not the slightest shadow of a doubt.

In connection with the promotion of educational handwork, they were all working for the benefit of the children, and their great aim was to make the coming generations wiser, happier, and better.

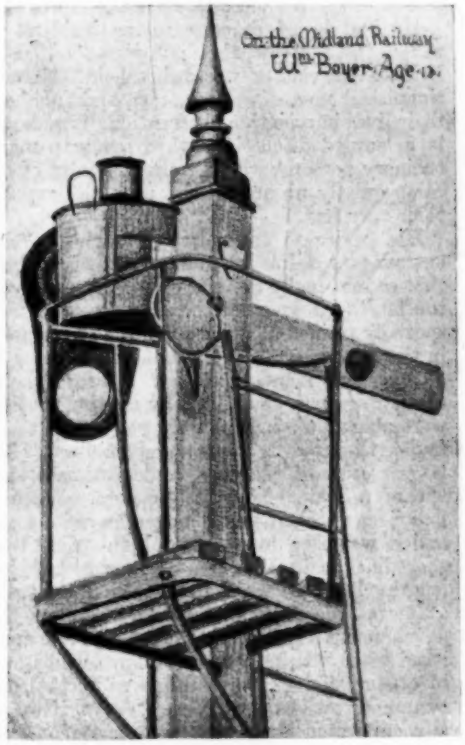
# OUTDOOR SKETCHING.

BY P. J. ATKINS, ART MASTER, LEICESTER.

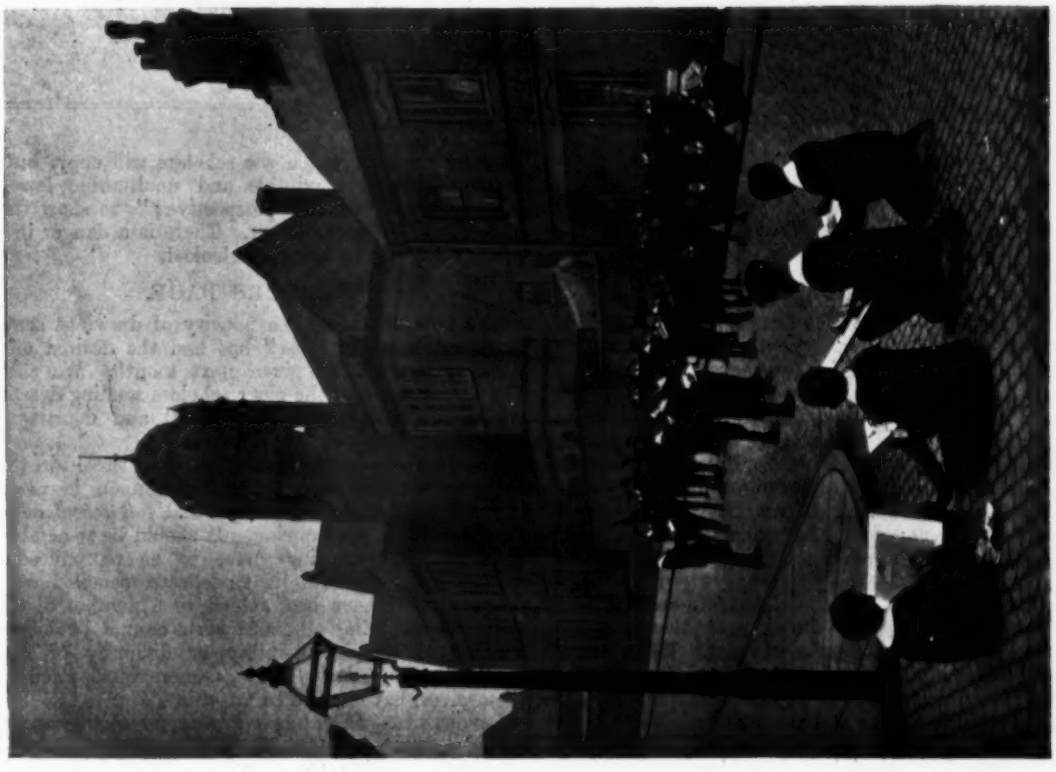
THE teacher who can arouse a healthy love of art in the minds of children, who can awaken their interests in surroundings besides securing the co-operation of his scholars, is on the high road to success. The idea of conventional models as a means to an end is good, but to stop at them is fatal. It is difficult for young children to realise that a cube is meant for a room, a rectangular prism with a triangular prism on the top for a dog-kennel, etc. It is far preferable to draw a corner of a real room, and use larger objects generally. When this is done the interest of the child is aroused, and there is no limit to his efforts. Let the children be taken to different parts of the town, and draw, under guidance, the different objects before them. Of course it will be found difficult to take a whole class at one time. The method I advocate is to choose all the best boys of each division, and band them into a "sketch club." We all know how boys value belonging to any club; it is inherent. Just as children form clubs for sports, so let one be formed in art—in fact, in any subject—and it will be the means of better work. The entrance to the club should depend solely on the merit of the scholars, and emulation will do the rest. Nothing must be taken for granted in drawing. The first principles of model drawing must be thoroughly mastered by all the scholars, or the scheme will spell failure.

The first illustration on page 525 is from a photograph by Mr. A. E. Vial, and shows the whole of the upper class at work, but near the school. Generally speaking, plenty of good subjects for study can be found to be drawn near the school. It will be seen that some are drawing a lamp, while others are busy sketching the gable end of a house.

The second illustration shows our sketch club, numbering twenty boys, making a sketch of the old castle gateway. It is wise to give a short historical account of special places of interest. The outfit necessary consists of an easel, board, and possibly a stool, although as a rule we sketch in the standing position. The scholars will usually buy all that is required.




Careful detail drawings are first made, followed later on by colour. It is as well not to be too ambitious at the outset. Draw parts of buildings, carefully finished, in preference to the whole. Never be content with slipshod work, but have a high standard of excellence. Do a little well, and, if necessary, visit the same place many times. With training like this boys are led to make sketches of places purely on their own incentive, becoming imbued with such a love of art that they will ultimately be only satisfied with it as a means of livelihood. This is no idle statement, for it has been tried.



OUTDOOR SKETCHING.

## EDITORIAL NOTES.

### OUTDOOR WORK.

PARTICULAR attention is directed to the article immediately preceding these notes. It suggests a line of work that is most important. Now that the weather is becoming more genial a great deal of excellent work can be done out of doors. It is not, of course, always convenient to take the class, as a whole, out into the open, but it is always possible to encourage the scholars to work for themselves in this way. There is not a single village, however small, or city, however large, but teems with similar material to that shown above. The principles taught through the ordinary geometrical models or simple common objects are applicable to the familiar things illustrated here. Indeed, we cannot say that the scholar does really understand the principles until he has applied them to exercises of this kind.

And it should be understood that there are scientific principles underlying the drawing of these things. Mere eye judgment is often insufficient. When errors of drawing creep in, it is only the knowledge of what must be, according to scientific principle, that enables the scholar or student to correct them.

In school the blackboard should be used continually for demonstrating principles. Not, be it noted, for drawing sketches which the scholars will copy, but to show them the inevitable and unalterable laws of what is usually called "perspective;" to show them, in fact, the grammar of art. There is a danger in the present day of this being overlooked.

### HONOURS PAGE.

The note regarding the paucity of drawings sent in for the "Honours Page" has had the desired effect. Another set will be given next month. We should like to see many of the older scholars sending drawings similar in character to the signal and doorway on page 524.

Teachers are again reminded that these drawings may be sent at any time. No coupon is needed. Write the scholar's name, age, and *full school address* on the back of the drawing. It should be remembered that all prize drawings have to be reproduced by photography, so that light, delicate pencil lines, or drawings that have been folded, or a number of small examples straggling all over a sheet cannot be selected, because of the impossibility or difficulty of reproduction. Many such drawings, meritorious enough in themselves, have had to be put aside.

IMPORTANT.—*In future all work for this competition should be sent direct to* Mr. J. Vaughan, 7 Campside Crescent, Langside, Glasgow.

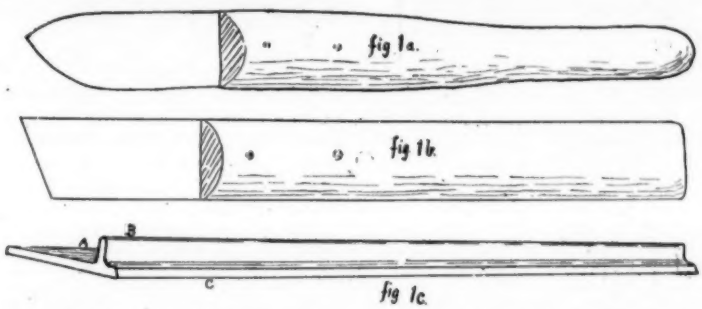
# CARDBOARD MODELLING.

BY FELIX T. KINGSTON, BARRY.

THE present stage, adapted to children of eleven years of age who have worked through the previous stages, brings us to cardboard modelling properly so called.

The following materials will be required :—

1. *Cardboard.*—This is produced in many varieties. The soft, unbleached wood-pulp board is cheap and easy to work, and may be used as the basis of those models which have to be covered with fancy papers. Then there is the bleached variety with partly glazed surface, similar to the ordinary postcard. This is much harder in substance and more difficult to cut than wood-pulp board, but owing to its more finished appearance is necessary for those models whose surfaces are to be left uncovered. We recommend the second variety for use throughout the course, because it is capable of more keenly-cut edges than the first-mentioned kind, and quality of edge is everything in cardboard modelling. It must be *not more than twice as thick as a postcard*, and should preferably be tinted, not highly coloured, so as to add to the beauty of the models, and to provide as much as possible of colour-training. It is usually sold in imperial sheets, assorted colours, at a price of about three-halfpence a sheet.




2. *Knives.*—The two forms in general use are illustrated. No. 1, the Leipzic pattern (Fig. 1*a*), is preferable to No. 2 (Fig. 1*b*), because its edge lasts longer. No. 2, having a straight cutting edge, is easier to sharpen. When purchasing, see that the blade is firmly riveted to the handle, and is not too thick. The quality of the blade is of primary importance, cutting tools of the finest steel being invariably cheapest in the long run. Knives will cost about sixpence each.

3. *Straight-edges.*—As the wooden rulers, which have done duty up to this point, cannot be used with knives, some form of metal straight-edge is indispensable. The safety straight-edge (Fig. 1*c*) has the advantage of rendering accidents to fingers impossible, while its weight helps to steady the cardboard; it is sold at one shilling. The knife travels along the edge C; the left hand rests on A; the ridge B protects the hand from the knife. A steel foot-rule well serves the purpose of a straight-edge, though being narrow it is difficult to hold in position during cutting. Steel rules should, however, supplant wooden rulers for the drawing of this stage, because accuracy is in much greater demand, and they may then be used also as straight-edges in cutting. The danger is, of course, that the fingers of the left hand will be cut while holding the rule in position, but mishaps of this kind will be avoided if knives are kept sharp and the cardboard is not thicker than previously specified. When the materials permit the pupil to cut with ease, there is none of that awkwardness which causes tools to slip. Steel rules, marked inches and centimetres, cost one shilling each; but as they can be used by all standards in rotation, and as they serve the double purpose of ruler and straight-edge, and, moreover, never wear out, they are cheap at the price. For these reasons, where economy is a consideration, we should recommend the purchase of steel rules rather than safety straight-edges.

4. *Binding.*—Strips of paper half an inch wide, ready gummed, assorted colours, can be obtained at sixpence per hundred. If the paper be bought in sheets, the strips can be cut by the teacher at one-fifth of the price. Strips of gummed cloth are obtainable for one shilling and sixpence per hundred. In the earlier models paper only will be required. It is far better training, of course, for the scholars to cut their own strips.

5. *Cutting-boards.*—It will be necessary to have a hard surface of some kind on which to lay the cardboard when it is being cut. Pieces of millboard and of strawboard are sold for this purpose at less than one penny each, and though they soon become indented with knife marks to the point of being rendered useless, they are cheap. Hardwood cutting-boards are to be preferred; they cost much more, but are easily planed smooth again when worn. Zinc plates, also sold for this purpose, are to be eschewed, because they blunt the knives.

6. *Covering Paper.*—This will be used for covering the surfaces of models in order to add finish and beauty.

During this stage all covering paper had better be purchased ready gummed. This raises the question of how far the pupil should be supplied with prepared materials. The answer is that he should be supplied with no prepared material that he can prepare himself. For example, the use of cardboard or paper ruled in squares to facilitate drawing is to be condemned from the very beginning, because the child is clearly able to do the necessary simple drawings himself. Render drawing dispensable and you deprive cardboard modelling of much of its educational worth; it is of the very essence of this subject that the child should construct a drawing, and make this very drawing into a model of some kind. Now as to the use of prepared covering paper, to insist on the child at this stage of his experience pasting his own will be to load the work

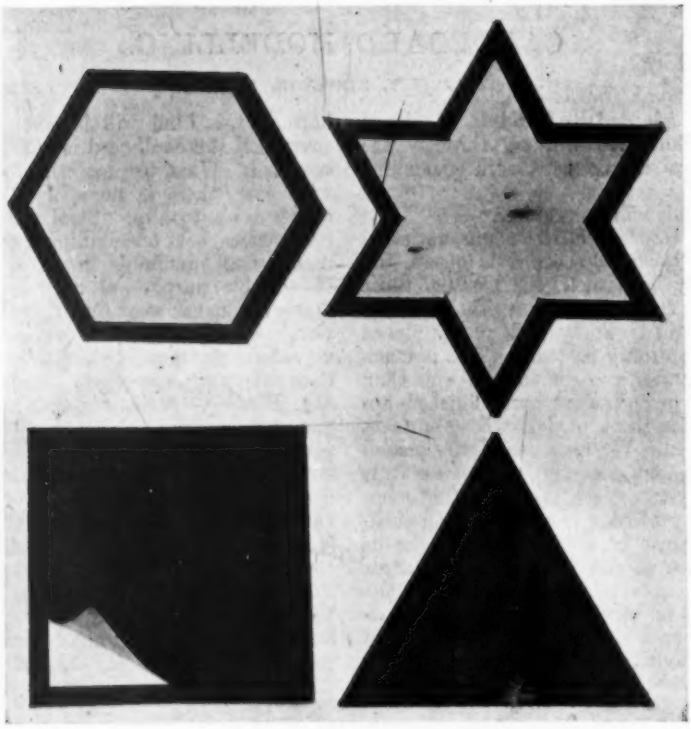


FIG. 2.

suddenly with too many difficulties, for the operation is one which demands greater skill than the child will have acquired; and as most models in thick card must for appearance' sake be covered, the solution of the difficulty seems to lie in supplying paper ready gummed.

For the geometrical models plain paper will be most suitable; for models which have a utilitarian end a decorated paper may be chosen.

Much of this material on the market is too crude in colouring to be of any value in the cultivation of taste,

FIG. 3.

and all but the quieter restful hues should be rigidly excluded. The cost will be about three-halfpence per imperial sheet.

7. An *oilstone* for whetting the knives will be needed, the cost being not less than one shilling and sixpence.

8. The *lead pencils* should be H or HH; never HB, which are too soft to give sufficient fineness to lines.

The drawing during this stage will be simpler in character, for new and sufficient difficulties will be

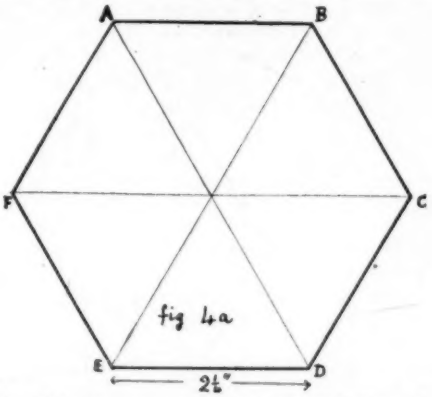


fig 4a

encountered in the use of the knife, in binding edges of models, and in decorating surfaces with covering papers.

The first few exercises will necessarily consist of the cutting, binding, and covering of easy plane forms. (See Fig. 2.)

### Model No. 1.—A Mat.

The teacher may introduce here either the regular hexagon or the octagon, or the choice between the two may with reason be left to the pupil. The model is to be cut out and the edges bound with paper.

The very first thing to be done is to teach the use of the knife. This tool should be held exactly as a pen is held in writing, the first finger resting along the

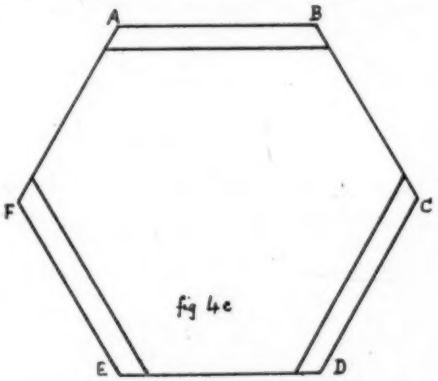


fig 4c

back of the blade, while the thumb and second finger grip the sides. Only the tip of the blade is used in cutting, and the knife will therefore be held at an angle of about 80° to the paper, as represented in Fig. 3, the handle sloping directly *towards* the operator.

Having obtained some thin card (say, old postcards or cardboard boxes), let the pupils cut it up into quarter-inch strips for practice. The card must lie flat and firm on the cutting-board, the straight-edge must point *towards* the body, and the knife be drawn also *towards* the body. It is better not to try to sever the card at one stroke. What the child needs first is to acquire the ability to keep the moving knife in contact with the straight-edge; delicate muscular sense perception is involved here, as in all subsequent use of the knife. Let the child draw the knife along several times without attempting to cut through the card, but merely endeavouring to gain sufficient steadiness of hand to keep the knife on the line. Even with young children

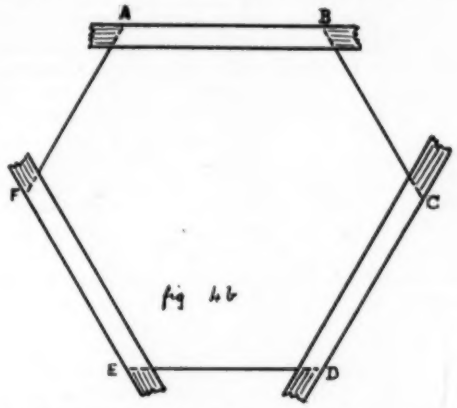


fig 4b

there is no necessity, if tools are kept in proper condition, for undue muscular strain in cutting. The body during the operation should be as erect as possible, avoiding unnecessary stooping, while the right arm should work freely from the shoulder.

It may be noted in passing that, compared with wood or metal work, cardboard modelling does not give as full play to movements of the whole body; it will be found sometimes necessary to interpose during the lesson a minute's corrective physical exercise.

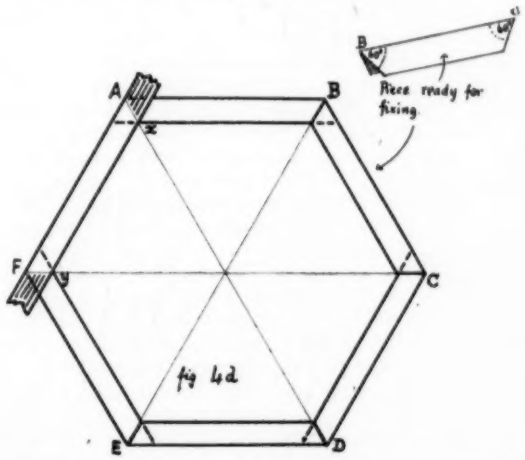


fig 4d

Having satisfactorily drawn the hexagon (Fig. 4*a*) the children will cut it out. (Put in the diagonals, for they will presently be of use.) One detail of manipulation must be attended to here: when placing the straight-edge along, say, AB, first place the point of the knife at one end of the line, and then bring the straight-edge up to it; this is more expeditious and more accurate than performing the operation without the aid of the knife. (The same observation applies to the joining of points in drawing.) The plane of the knife-blade must be at right angles to the plane of the card-

board—that is, though the handle slopes slightly towards the operator it must not slope either to his right or to his left, so that the edges of the cut cardboard may be perpendicular to its surface.

The next process consists in binding the edges. Having chosen a strip of binding paper of suitable colour to harmonise with the card, fold it, gummed surface inwards, very carefully down the middle. This is *not* the insignificant task which it appears to be; the strip should be folded with thumb and finger at every inch, and then smoothed along its length. One edge of the strip must on no account project beyond the other, or irremediable errors will ensue.

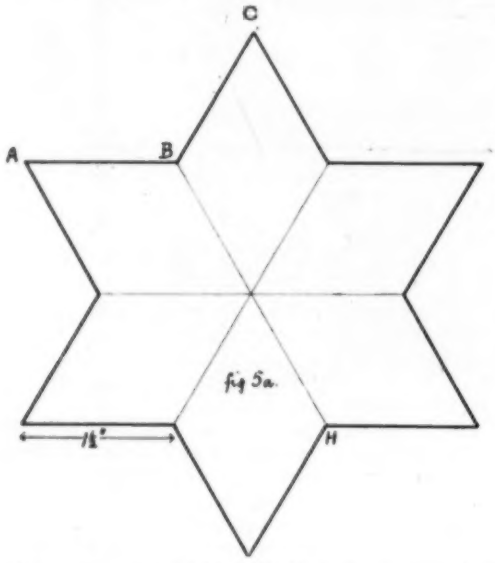


fig 5a.

Take a piece of the folded binding, about three inches long, moisten the gummed surface, and fix it to the edge AB, allowing the ends to project a little beyond A and B (Fig. 4*b*). Next fix similar pieces on the alternate edges CD, EF. With scissors cut off closely the projecting ends, and these edges will appear as in Fig. 4*c*.

The pieces of binding for the remaining three sides must be cut to exact length—namely, two and a quarter inches—and their ends mitred at 60° where they overlap the ends of the first three pieces. The work may be done thus: Place one of the folded pieces in position (see AF, Fig. 4*d*), and with the pencil mark the short lines A*x*, F*y* along the diagonals. Remove the piece and cut away the part shaded, and the strip is ready for fixing. The completed stage is illustrated at B, C, D, E (Fig. 4*d*).

In binding future models the same order will be observed—namely, first fix as many pieces as possible, the waste ends of which can be cut off flush with any edges of the model; next fix those pieces whose ends have to be mitred, noting that a piece is invariably to be mitred where it overlaps another.

### Model No. 2.—A Star.

The hexagonal is the form chosen (Fig. 5*a*). For the slower pupils the teacher may substitute a tetragonal star. This model also is simply to be cut out and bound.

The new points which occur are—the cutting and binding of a re-entrant angle. When cutting, proceed *outwards* from, say, B to A, and then *also outwards* from B to C, forcing the knife well into the card at B when commencing each stroke to ensure getting a clean-cut corner.

As to the binding, it will be found that the strips cannot overlap at B, but that the mitred ends must be made to lie edge to edge—a much more delicate operation. Tear off a strip of binding paper, fold it, and lay it along one edge of the star, say BA (Fig. 5*b*); mark the position of the mitre B*m* along the diagonal BH. Remove the strip and cut it off along B*m*, and it is

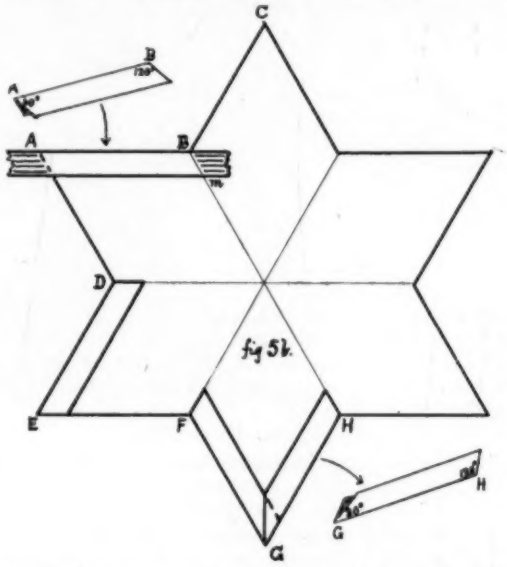


fig 5b.

ready to fix; the waste at A may be cut off after fixing. The strip then appears as at DE (Fig. 5*b*). The piece of binding which is to cover the adjacent edge AD will be dealt with in a similar way, except that, before fixing, it must be mitred at 30° where it overlaps the other at A. One finished corner is shown at FGH, where the piece GH overlaps the piece FG at G.

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*Essentials of Woodworking. By Ira Samuel Griffith.* (*Manual Arts Press, Peoria.*) 5*s*.

Manual training is gradually taking its proper place in the curricula of all schools, and its educational value is fully recognised. Those teachers and organisers who have the success of the work at heart have realised, too, that manual instruction means something more than merely working with tools. The boys must be taught also what Mr. Griffith calls the "essentials of woodworking." This means a thorough knowledge of the construction and use of tools, and their fitness for the particular work they have to do; the various processes used in joinery; the growth, supply, seasoning, storing, and cutting of timber; the properties of various woods; staining and finishing; working drawings. All these points are fully dealt with, and there is no gainsaying the fact that the more a course of manual training deals with these things, the more educational it becomes, and the less mechanical and trade like. In common with all books issued by the Manual Arts Press, the get-up leaves nothing to be desired.

# NOTES AND SUGGESTIONS ON THE TEACHING OF EXPERIMENTAL SCIENCE, MATHEMATICS, AND DRAWING.

BY C. HAMILTON.

## I.—A Preliminary Skirmish.

OF the educational controversies that have raged during the last ten or fifteen years few have been more fruitful than those which centred round the teaching of elementary mathematics and science. The columns of educational periodicals have borne testimony to the zeal with which teachers were devising new schemes, and the publishers have showered text-books upon the earth in such profusion that the light which might have helped a young teacher on his way has been obscured. For these books have dealt mainly with practice, and in the divergency of practice arising out of the hundred and one accidents of accommodation, equipment, school organisation, and type of pupil, general principles have escaped recognition.

For the benefit of those who have not followed the hurly-burly, it may be stated that the main struggle arose in the early 'nineties, when organised science schools were established in numbers all over the country. The instruction had of necessity to be put into the hands of those who, while professional teachers, had received very little scientific training, or of young men from the universities and university colleges whose scientific knowledge was above reproach, but who lacked both knowledge of educational theory and experience in teaching. As compared with the teaching of other school subjects, therefore, science teaching was at a disadvantage. There were no long years of experience, nor was there a great tradition behind it; and the early methods and results were disappointing.

Probably the main defect was the natural attempt, in the absence of any rational or historical standard, to impose university methods on schoolboys. Thus lecturing took the place of teaching; the apparatus was complicated; the experiments were unsuitable, aiming too much or too little at numerical results; and learners were put in the position of those who receive rather than of those who acquire information. The tendency in this country to regard training in methods of teaching as of little or no value, the prevalence in the training colleges of an obsolete psychology, and the absence of books containing sound and modern information on the principles of teaching, left science teachers to work in the dark, or placed them at the mercy of every man who dared to advance a policy or publish a text-book.

The central figure in all the discussions has been Professor Armstrong, who, in season and out of season, and in many writings, has advocated what is known as the heuristic method of teaching. According to this plan the pupils are put in the position of inquirers; they devise their own apparatus, carry out their own experiments, and learn at first hand. The essence of the method is not that the teacher teaches, but that the learner learns, and it represents in its broad outlines a plan of teaching older students through self-activity not very dissimilar from that devised by Froebel for younger ones.

The plan was eminently successful in the hands of teachers who possessed enthusiasm for research. Schemes were worked out and text-books were published in abundance; but in spite of all there existed, and still exists, much of the old masquerading as the new. Teachers have been ready enough to adopt the matter of the new teaching, and the experiments devised during that period of activity are the stock property of the science teacher to-day. But the spirit has made slower progress.

For this there are many reasons, chief among which is the fact that the question of teaching was only dealt with in an incomplete fashion. The methods at first were only fully worked out for chemistry. Certainly the properties of gases were included, and specific gravity was done to death. Nevertheless, chemistry was the main subject selected for heuristic treatment, and the methods of the early chemists formed the backbone of the plan. Advocacy of the method was accompanied by much "special pleading," and the arguments in its favour were mainly from the standpoint of the subject rather than from the theoretical basis of teaching—a basis which was frequently not only ignored but condemned. Teachers who were imbued with the spirit of research saw the value of the proposals, and worked out their own schemes under the normal conditions of school life. But teachers who were not enthusiastic chemists met with much more difficulty, for the arguments were either not read by or were unintelligible to them; and as there is no definite requirement that science teachers shall show evidence of having studied the theory of teaching or even the heuristic system, the good which this system did in the height of the controversy extends at only a moderate rate.

But while the heuristic system rests on a sound basis, it is only a partial expression of those wider educational principles which lie at the basis of all teaching of subjects which add to knowledge as distinct from skill. In making this statement there is no desire to belittle the work of those who have raised the teaching of science to the position it occupies to-day, and it is impossible to refer to this early period without acknowledging the debt which science teachers owe to Professor Armstrong, less perhaps for his advocacy of the system than for the stimulus which led so many to search for sound principles and aim at the best practice.

Efforts for the improvement of mathematical teaching have been spread over a much longer period than in the case of science, and have been exercised in several directions.

The Association for the Improvement of Geometrical Teaching has been in existence since 1870, and has recently seen the fulfilment of one at least of its aims in the expulsion of Euclid's elements from the schools. It is now generally recognised that the study of deductive geometry should be preceded by a preliminary course of practical geometry, but it must be confessed that the transition is in many cases rather abrupt. A point that is receiving tardy recognition is that the learner should acquire his facts by the method of induction or inference. Of synthetical development upon these lines, however, many of the earlier courses show little evidence, and the pupil still jumps into deductive reasoning at one stride—only a little later than before. On the whole, the tendency to keep inductive and deductive methods wholly apart is probably a result of the swing of the pendulum, and a recent book * makes an interesting attempt to bring the two into closer union.

* *A Manual of Geometry.* By W. B. Eggar. (Edward Arnold.)

Another phase of the development is to be found in the indiscriminate use of arithmetical, algebraical, or geometrical methods in the solution of problems. So long as algebra and geometry were regarded as deductive sciences, each had to be developed upon its special axioms, postulates, and definitions. The schoolboy was then, in effect, a little mathematician whether he was built that way or not. It is only recognition of the fact that mathematics was created for man rather than man created to be a mathematician that has delivered the schoolboy from the yoke of the specialist oppressor.

The final results of the deliberations of the Association already referred to, of the Mathematical Association, and of Committees of the British Association have been profoundly modified by the influence of Professor Perry. Regarding mathematics almost wholly as a practical art, he has shown how mathematical operations belonging logically to the higher stages of the subject may be brought within the range of comparatively elementary students. In this manner the power of dealing with subjects formerly fenced in by a barrier of higher mathematics has been enormously increased.

Professor Perry's views have obtained widespread currency through the institution of the examination in practical mathematics by the Board of Education. Like most examination methods of propaganda, however, the syllabus is variously interpreted, and the work of the schools ranges from pure mathematics of a more or less antiquated type, and but thinly disguised, on the one hand, to the mere working of practical examples on the other. It becomes necessary, therefore, to inquire more closely into the meaning of the term.

The question was recently put to a teacher of experience, who replied with Gaelic scorn, "Practical mathematics is mathematics with the rot cut out." So far, so good. Provided that "rot" is defined as those mathematical laws, operations, and generalisations which the student is never likely to use, the explanation may be accepted as a first approximation to the truth. The view is developing slowly but surely that knowledge which the student is unlikely to use, or skill which he is unlikely to exercise, after he leaves school, is so much waste lumber in the mind. So far as the needs of most boys, and certainly of all those of the type considered, are concerned, mathematics is a means rather than an end. It is necessary to give precision and exactness to their ideas of distance and time, size and shape, weight and cost, profit and loss. So much of mathematical knowledge and dexterity as will suffice for the practical needs of life is of paramount importance; anything beyond that must take its chance with playing the piano, pitch and toss, or any other of the little accomplishments with which a man may occupy his leisure hours.

But the explanation which has been provisionally accepted is only a partial one, in that it does not distinguish practical mathematics from pure mathematics in disguise. It is a surface explanation, limiting the scope but not penetrating into the method of teaching, which is the essence of the whole matter. The tendency is to regard mathematics as a subsidiary subject of the curriculum—in aim but not in importance. If progress in the main subject of instruction renders it desirable that the students should know and use a mathematical truth which cannot at that stage of their mathematical progress be proved by the rigid methods of mathematics, the truth may be demonstrated to them by the study of particular cases. In other words, the truth may be approached inductively. Practical mathematics is therefore an attitude of mind rather than a subject, and in modern text-books* mathematical formulæ are established by measurement of the geometrical relations and then applied to practical problems.

The justification of this method may be sought either in expediency or by appeal to educational theory. In the first aspect it may be said that the practical man stands in need, not of mathematical methods, but of mathematical results. So long as he can understand the way in which the result can be obtained, even though that is not according to the traditional mathematical process, he cannot be described as working blindly or with lack of intelligence. To assert that a man must acquire by the specific methods of a science all that knowledge of it he desires to use is a counsel of perfection. If the road to heaven lay only in knowledge of theology, many congregations would indeed be in a perilous condition!

Difference of opinion on this point arises from a confusion between mathematical thought and the mathematical art. The first ideas of number and counting developed when man began to distinguish more than one object of the same kind, or to reckon his journey to or from the hunting-ground or his home as so many moons. The power to synthesise (add and multiply) and to analyse (subtract and divide) increased with his growing needs and his practical requirements. So in the same way his earliest attempts at construction were limited by necessity, and mathematical thought, architecture, and decorative art were not practised until triumph over his surroundings provided him with leisure and enabled him to turn from the concrete and practical to the abstract and æsthetic.

It ought not to require much exercise of the imagination on the part of the teacher to regard the average boy as a barbarian. There is at least some similarity in the fact that neither of them displays much anxiety to contemplate abstract and universal truths. The average modern boy would certainly appear happier if his mathematics could be confined to his immediate practical needs, for that would leave him more time in which to follow other and more attractive interests; and when the boy, having left school, has entered upon his life's work, he is in need to a far greater extent of mathematics in its practical and subsidiary aspects. It may be contended, moreover, that until he is fifteen or sixteen years of age he will respond more readily to savage methods of instruction.

The natural process by which the human mind acquires knowledge is through the study of concrete and particular cases. The ideas thus obtained, analysed, compared, contrasted, classified, and arranged lead to general truths, which in turn are tested by application to particular cases. In the early stages of mental development the formulation of the general truth is slow, and it is not observed until by the summation of experience it obtrudes itself upon the mind. The process in this case is sub-conscious. But in the active search after truth more or less probable guesses are made, which are called hypotheses; and these, tested by further experience and by the application to particular cases, may be rejected as invalid or raised to the dignity of laws.

* The most satisfactory is Consterdine and Barnes's *Introduction to Practical Mathematics*. (John Murray.)

The other method of increasing knowledge is to start with certain self-evident universal truths, and after defining terms and postulating conditions to prove other truths also universal by reference to the original axioms and definitions. This is the deductive method, and it presupposes a certain ability of mind to conceive of a universal truth which is not usually found in beginners or children.

The cry will likely enough be raised that in relegating mathematics to a subsidiary position in the curriculum, and in making it subservient to some less exact concrete subject, there will be lost all that training in accuracy of thought and deductive reasoning that the study of mathematics is supposed to give. But the claim of general mental training on behalf of this or any other subject must be taken *cum grano salis*, for if it has any foundation in fact mathematicians must indeed be the salt of the earth; and the plain truth is that outside their special province they are not saner than other men.

It will have been gathered from the foregoing remarks that for present purposes mathematics is to be regarded as a practical art, and all arts involve acts more or less habitual. Most people, and especially students, of the type under consideration think in things rather than in the abstract, and a number means to them so much of something, or has no meaning at all. The aim therefore is to train them in the habit of thinking about measurable things in a quantitative way.

Habits of thought, however, are only valuable in so far as they obey the rules of logic—that is, so long as the reasoning follows the inductive or deductive method. Since the object of most of the reform of mathematical teaching is to escape from the formality of the deductive method, which is not suitable for beginners, the inductive method alone remains.

The point of contact between mathematics and science has now been reached. The concrete material through which the pupils reach their mathematical truths and obtain practice in calculation is form. But while the use of drawings or paper figures to illustrate mathematical truths is common enough, the attainment of these truths by logical methods is rare. The teaching of elementary practical mathematics stands to-day where the teaching of experimental science stood twelve years ago. It is the old story of a new attitude being mistaken for a new subject.

The object of this series of articles is to explain how mathematics can be taught as a habit. Where the habit is acquired through geometrical drawing and measurement of form, there is not much room for originality. In the scheme to be described, however, the measurement of length will be followed by examples on velocity, and volume will be followed by lessons on weight, weight considered as a force, comparison of forces, and elementary mechanics. The consideration of relative weights will lead to ideas of relative density, specific gravity, the properties of liquids and gases, and the barometer. Then, having dealt with the commoner physical properties of bodies at the ordinary temperature, further inquiries will be made into the effects of heat upon matter and thermal measurements.

The writer will have in mind the capacity of boys between twelve and sixteen years of age. While the scheme will be based mainly upon the requirements for the Preliminary Technical Certificate in evening schools, it is hoped that most of it will be found not unsuitable for higher elementary, preparatory trade and higher grade schools, and the upper standards of elementary schools. In view, moreover, of the interest which is at present being displayed in the relation between mathematics and science in the earlier years of the secondary school, the suggestions may be of wider interest than is indicated by the first intention.

Preparation for the Preliminary Technical Certificate involves practical mathematics, practical drawing, elementary science, and English. In some schools elementary science is taught in the second year only; in others it is taught in both years. In some cases drawing and mathematics are taken by the same teacher—at any rate in the first year. In other cases the two subjects are taught by separate teachers. Some examining bodies say that drawing and mathematics are to be taught in close association, but unless they are both under the same teacher this is difficult to carry out. Again, the earlier portions of the course in elementary science are practically the same, and demand the same method of treatment, as portions of the syllabus in practical mathematics. There is thus much duplication, waste of time, and confusion, and inductive teaching becomes impossible, while examination schedules are taken as teaching syllabuses.

The scheme which follows involves for two years a logical course of experimental geometry passing into experimental science. Quantitative treatment of these topics provides practice in mathematics in both years. A few supplementary exercises in drawing in the first year enable the syllabuses in mathematics and drawing both to be covered, and for this purpose four hours a week are required. The remaining two hours can be devoted to English and composition, or one hour to this and the other to sketching, drawing, or numerical exercises.

In the second year it is assumed that four hours per week are given to mathematics and science, and two hours to drawing, which, as a rule, will be under a separate teacher.

Finally, attention may be drawn to the system now fairly well understood of arranging school pursuits into groups, in which one subject forms the main line of study, and the others arise from and are associated with it. The parallel will become clearer when we come to the scheme in detail. It will first be necessary, however, to discuss the general principles which underlie the method, and this deserves a separate article.

(*To be continued.*)

## SPECIAL NOTICE.

THE series of articles of which the foregoing is the first will be continued during the year. The work is so planned that Continuation School Teachers will be able to examine the whole scehme of work in good time for drawing up the syllabus for the work of the 1909–10 Session. Examples for class use will be given, and the whole series will be of a strictly practical and helpful character.

Please make this series of articles known to Teachers in Continuation Schools.

# The Wander Years.

IT seems but yesterday that we laid down Mr. Yoxall's *Château Royal* with a feeling of satisfaction such as few modern novels can now impart to us; and to-day Messrs. Smith, Elder and Co. send to us a volume of a somewhat different character, but of equal, if not greater, appeal. Its title stands at the head of this page, and in the Preface we get a further indication of its particular character:—

"After school and college and other apprenticeships come our journeyman days in the world, and our wander years into life and letters and art and the wonderful city of Mansoul. Journeymen in Georgian days had to perform some attested bit of skilful work before they could be made free of their craft and guild: many such trial pieces in brass now rest on the shelves of the room in which I write; quaint and insufficient they appear to-day—the world has rolled past them—and my book may appear both inadequate and brazen. But it is difficult for an essayist to seem as modest as he really is."

The book is formless as to plan, but beneath its gay and genial irresponsibility we find a consistent unifying motive. The writer gives full play to that dormant sense of wonder which our modern education tends to suppress. There is a tender little couplet of Stevenson's which we have been accustomed to associate only with childhood, but Mr. Yoxall makes it applicable to the prime of manhood and womanhood—nay, even to what he calls the October of life:—

"The world is so full of a number of things,
I'm sure we should all be as happy as kings."

Even the Board of Education cannot wither Mr. Yoxall, nor Circulars and Suggestions stale his infinite variety. Figure him—we have slightly caught his manner—reading some circular from Whitehall redolent of the New Nervousness, laying it down and sauntering—surely he is the only saunterer of the century—sauntering home to Richmond by way of Charing Cross Road, where the book boxes are *not* disinfected.

"Out of a sixpenny box there I recently picked a relic of old Continental travel. It is a work by the worthy Karl Baedeker, still published, I believe—the *Traveller's Manual of Conversation* to wit. And listen how milords used to have to talk abroad, on the Grand Tour. 'Is the road safe? Do you ever hear of robbers? Are the postilions insolent? Is the road over the mountains very steep? .....Postilion, mind you go slowly when the road is bad, and when you make a turn. Postilion, stop! We wish to get down; a spoke of one of the wheels is broken—some of the harness is undone—one of the horse's shoes is come off.' And listen, again, how they went aboard ship. 'Get into the boat, gentlemen; take care not to hurt yourselves. I think the sea is very rough. The vessel is a great way out, and if a gale of wind comes on the boat may be upset. My head is very bad; the smell of the tar afflicts me. Drink some hollands; it will strengthen your stomach. I think we ought to see the coast now; we have been ten hours on the way already.' That was how they went over from Queenborough to Flushing or from Deal to Dunkirk."

Our essayist can affect without affectation now the manner of Thackeray, now that of the gentle Elia, now that of those immortal vagabonds Hazlitt, Stevenson, and De Quincey. For example, might not Charles Lamb himself have written the following?—

"Hobbinol watches with me as the biograph of the centuries reverses, and early we perceive a certain clerk. Perched on a giant stool, he elbows a monumental desk, his absurdly short and spindly legs bedangle, and his fidgety feet spurn air. In a dusty and fusty part of a Palladian building in Leadenhall Street we discover him; on a torrid afternoon in Eighteen hundred and—nay, the Waterloo year, let us say, though no rap cares he for Waterloo or Wellington; *his* hero Boney, if any. There is little oxygen anywhere near him; the windows are shut; the fresh air cult is not yet known. Pent at what he calls his 'dry drudgery of the desk's dead wood,' he is totting up John Company's receipts from an auction of Chinese porcelain—a thousand crates of it, lately discharged by the stout ship *Sunderbund* upon the Poplar wharves, and orientalising the dinginess there. The little brown-coated clerk frowns terribly at the figures before him, for the sales still lessen and the profit dwindles, it seems. Yet 'By the mass!' he declares, 'this Kien-lung and Kea-king ware is as winsome as ever!' Witness the voucher teacup and saucer on the flat of the desk, ensamples of the *Sunderbund's* delightful cargo. 'I wish I might buy it all for Mary!' says the clerk."

Mr. Yoxall's own knowledge of china is evident in many of the pages of this book, and even as a connoisseur he remains genial and ready to instruct the novice. As a rule your connoisseur is not a clubbable man—he knows too much—but our author's hobby-riding has not filled him with the usual scorn for the pedestrian. There is throughout the talk of Chelsea, Sèvres, Dresden, and what not, a lightness of touch which reminds us that this is not the business of life; a readiness to let it go and to discuss matters of an entirely different character—witness the pages of what we might call prophetic history in the chapter entitled "Spinning-Wheel and Rifle," pages which knit the brow, compress the lips, and stir the fighting impulse better than the roll of drums.

How deliciously, too, our author can vitalise those historic memories of places which usually fall so flat upon the tourist's ear. Take, for example, the pathetic note on Joan of Arc in the description of "Chinon by the blue Vienne," or the account of Wellington at Brive in 1814. These things are also in the official guide-book, but how gladly we pass them by. Would that Mr. Yoxall could write our guide-books—and our histories! Take, for example, his impassioned defence of Madame de Warens in "A Broken Lance," and the delightful glimpse of the fugitive Corsican on his way to take up his imperial duties in the Isle of Elba.

Space forbids further excursions into this delightful book, which ought to be owned and read by each member of the N.U.T. We have only one grumble: our essayist loves the exotic word, and he does *not* print it in italics. The effect upon the ordinary reader is, to say the least, disturbing. And in one place, finding *courrier* at the end of a page, and not knowing that there was a context, we were seized with the dreadful thought that, like Chaucer as viewed by Artemus Ward, Mr. Yoxall "cuddent spel."

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MESSRS. J. M. DENT AND CO. will shortly issue a handy pocket volume, entitled *The Temple Shakespeare Lexicon and Concordance*, which will be uniform with the well-known "Temple Shakespeare."

The reader of Shakespeare will find brought within the compass of this small volume a selection of variorum readings and interpretations of words, and of the chief phrases which have given rise to discussion, drawn from the principal commentators, from Johnson to the present day, including the latest contributions to those given in the *Oxford Dictionary*.

The words chosen for the glossary are those which have fallen into disuse since Shakespeare's time, or which have undergone a change of meaning; others are added that were used by him with a variety of signification.

The glossary is accompanied by a concordance, and illustrations from authentic sources have been introduced as a further help to the understanding of words referring to dress, armour, etc. All owners of the delightful *Temple Shakespeare*, please note.

# MORAL TEACHING FOR INFANTS AND JUNIORS.

BY MABEL A. BROWN.

*Scheme for April.*

Central idea—Work.

*Divisions of Subject.*

Week 1. The universality of work—its purpose, value, and dignity. "Satan finds some mischief still for idle hands to do." The dangers and evils of unemployment. Many kinds of work besides that of actual manual labour; all good if done in the right spirit. Value of rest, sleep, and leisure enhanced by good solid labour.

Week 2. Industry and patience in work—no desultory labour. "Whatsoever thy hand findeth to do, do it with thy might." Steady, concentrated effort required if work is to be of value. Satisfactory results do not always immediately follow application and effort. Instance the building of lighthouses—the work of weeks sometimes washed away in a single storm.

Week 3. Perseverance; facing difficulties; rising after a fall with courage and determination. "Be not weary in well-doing; for in due season we shall reap, if we faint not."

> "To dry one's eyes and laugh at a fall,
> And, baffled, get up to begin again."—BROWNING.

Week 4. Self-reliance. Confidence necessary to do good work. Timidity and self-distrust often spell failure. Self-reliance of no value unless accompanied by industry, patience, and perseverance. Old saying: "If you want a thing done well, do it yourself." Self-reliance not the same as self-sufficiency and pride.

> "No man is born into the world whose work
> Is not born with him; there is always work
> And tools to work withal for those who will;
> And blessed are the horny hands of toil."—LOWELL.

*Suggested Teacher's Reading.*

Lowell's *Columbus* and *A Glance Behind the Curtain;* Emerson's *Essay on Self-Reliance;* Thoreau's Essays—for views on work. Thoreau's life. Lubbock's *Ants, Bees, and Wasps.*

*Scripture.*

Story of Jacob's labour and service—(1) for his cattle; (2) for his wife (Gen. xxix., xxx.). Joseph's work in the land of Egypt (Gen. xli.). The work of Christ. His Father's business (St. John ix. 4). His busy days of work for others—teaching, healing, etc. His weariness (St. Mark iv. 35). Long nights in prayer (St. Mark i. 35, vi. 46). His teaching about work. Story of talents (St. Matt. xxv. 14–30). For other Scripture references about labour, see Ps. civ. 23; Eccles. ii. 24, v. 12; Prov. vi. 6–8; 1 Cor. iv. 10; Acts xviii. 3. One of these passages may be chosen as the motto for the month. All may be memorised if thought desirable.

*Hymns and Songs.*

"Work, for the night is coming" (Sankey and Moody). "Little drops of water" (Sankey and Moody). "Suppose the little cowslip" (Sankey and Moody). "If I were a sunbeam" (Sankey and Moody).

*Recitations.*

"King Bruce and the Spider," "Try, try, try again."

*Games.*

"The Bees," "The Raindrops," "The Wind" (Keatley Moore's *Song and Game Book*).—"The Rain Cloud," "The Wind" (Eleanor Smith's *Songs for Little Children*).—"Where go the Boats," "Looking-glass River" (*Child's Garden of Verse*).

*Stories.*

Tell stories of some of the world's greatest workmen: Men of science: Newton, Watts, Stephenson, Edison. Explorers: Livingstone, Stanley, Cook, Drummond, Nansen. Statesmen: Peel, Fox, Wilberforce, Gladstone, Disraeli. Soldiers and sailors: Gordon, Clive, Nelson, Wolfe, Wellington. The building of lighthouses might be taken as an illustration of work requiring patience, industry, perseverance, and self-reliance. (See *Children's Encyclopædia*, Vol. I.) The labours of Hercules might also be taken (*Book for Bairns*, No. 27). Tell story of King Bruce and the spider.

*Nature Study.*

Animal Life.—The ant, bee, and spider—examples of industry, patience, and perseverance.

Plant Life.—Germination of seeds—the farmer's patience between seedtime and harvest; his patient waiting, combined with increased labour and anxiety, in seasons of drought or excessive rain. (Take story "The Master of the Harvest" in *Earth's Many Voices.*) No hurry in Nature—everything comes in *due* season—man cannot hurry or retard the work of Nature. Continue study of tree buds.

Natural Forces.—The work of the world's great forces—water, steam, fire, electricity. The earth's great purifying agents—the wind, the rain, rivers, the sea.

*Note.*—For the lower standards take more especially the section on natural forces—combine with stories of inventors and discoverers. For the infants, dwell more upon the animal and plant life suggested.

*Kindergarten Occupations.*

Juniors.—*Brushwork.*—Study in sepia, showing section of an ant hill. Designs based on the hexagon.

Infants.—A piece of honeycomb. A spider's web and spider. A straw skep for bees. Germinating seeds. Developing tree buds.

Juniors.—*Drawing.*—A rain gauge. A kettle. Bees—various types. Free designing in hexagons. A spider.

Infants.—An umbrella. A weathercock. A vane. Hexagonal designs on one-inch squares.

Juniors.—*Sand Modelling.*—Model showing watershed, with rivers running to the sea.

Infants.—*Paper-folding.*—Designs folded from the hexagon. An umbrella.

Juniors.—*Paper-cutting.*—An umbrella.

Infants.—Bee-hives—old and new style. Picture to illustrate wind.

*Clay Modelling.*—A drain-pipe for umbrella-stand. A glass. A kettle.

*General Note.*—The scheme for this month presents difficulties for children of six, and the lessons which give the leading thoughts need to be made clear by homely everyday examples and stories rather than those I have sketched. The difficulty lies only in the central idea and literature; the other sections are quite suitable. Good stories for infants in this connection are "Cobwebs," "Waiting," "Law of Authority and Obedience"—all taken from *Parables from Nature*. "Arachne," from *Nature Myths and Stories*; "Ariadne," from *Legends of Greece and Rome*.

## A SCOTTISH EXPERIMENT.

IT is now being felt in many quarters in Scotland that Supplementary Classes have had a sufficient trial, and that steps should be taken to put them on a more solid basis. Before indicating in what directions improvement is to be made, it may not be out of place to give some idea of the function these classes are intended to fulfil in the primary school system of Scotland. According to the nomenclature recently adopted by the Education Department, a primary school is a school, or a department of a school, giving an education based upon English to pupils who are below the age of fourteen. A primary school may contain individual pupils or small sections of scholars who are being instructed on the lines of an intermediate, or even, in exceptional circumstances, of a secondary school.

The Supplementary Classes form the apex of the primary school. At twelve years of age a pupil may pass what is designated as the Qualifying Examination. This examination may be looked upon as the preliminary examination for entrance to Supplementary Courses or to intermediate and secondary schools. The Supplementary Courses are designed, therefore, for pupils between the ages of twelve and fourteen who do not elect to go to an intermediate or secondary school—in short, for those who propose to finish their primary school course at the exemption age of fourteen.

The subjects of instruction are so arranged that pupils may take either (1) the Commercial Course, (2) the Industrial Course, (3) the Rural School Course, or (4) the Household Management (Girls') Course. All pupils, however, whatever course is adopted, must take certain subjects in common. These comprise, among others, the study of English, of which the main object is to create a taste for good literature. The means to be employed for carrying on this study are systematic home reading, with properly directed choice of books; efficient reviewing, explaining, and testing in school the work done at home; the committing to memory, after discussion and explanation, suitable pieces of verse and prose; the systematic teaching and practice of English composition. In addition to English it is proposed that all pupils should have certain general studies bearing upon matters which it concerns the pupils to know in after life, whatever the occupation followed may be. Under this heading are specified the laws of health; money matters—thrift, investment, and insurance; the conditions of trade and employment; the institutions of Government under which we live; the Empire—its history, growth, and trade; our Colonies, and the openings for enterprise which they afford; Nature study, drill, and singing. It is not considered imperative that all the topics mentioned under this heading should be taken up with the same set of pupils. It is, however, of the essence of the proposals that there should be at this stage of school life a certain amount of concentration upon the more important subjects of the curriculum. All these subjects are usually known as Schedule V.

Schedule VI. lays down the instruction special to the several courses. In the Commercial Course we have commercial arithmetic, bookkeeping, commercial documents, writing, and shorthand. In the Industrial Course are included geometry and mathematics, applied arithmetic, woodwork or ironwork (or both), and mechanics. The course for rural schools comprises Nature study, geometry, study of newspaper markets reports, the keeping of accounts, and woodwork or ironwork. The Household Management (Girls') Course includes housekeeping, care of rooms, furnishings, and clothing, marketing, cookery, laundrywork and needlework, laws of health, arithmetic, scale drawing applied to the making of diagrams for cutting-out, and dressmaking.

These courses have now been in operation in Scotland for five years, and the universal testimony of inspectors is that they form, when well conducted, an excellent coping-stone to the substructure of elementary education which it has been the work of the previous school years to erect. The pupils in these courses are overtaking a large amount of work both practically useful and intellectually stimulating. The difficulties in the way are by no means few. In very many cases, unfortunately, the children are nearly fourteen years of age before they are qualified to enter the course. So long as this state of matters continues, the courses cannot flourish to the extent they should.

In order that the large majority of pupils in the primary schools may take full advantage of these courses, it is necessary that they should be ready to pass the Qualifying Examination at the age of twelve. It is calculated that 11 per cent. of the pupils in average attendance at any school should pass this examination. As a matter of fact, in no district in Scotland is this percentage reached. Various reasons have been given for this deficiency. In the first place, it is due to the late enrolment of many pupils. In Scotland, since the passing of the Education Act of 1901, the age of enrolment has been gradually rising, and as a result new methods of classification have had to be adopted so that the pupils may be able to overtake the work of the infant, junior, and senior divisions of the school in a shorter time. Irregular attendance, too, has had a very visible effect on the number who have been found fit to enter Supplementary Courses.

Notwithstanding all these drawbacks, the percentage all over Scotland has been gradually increasing, but still in many districts pupils have entered the Supplementary Courses too late to profit to any great extent by the instruction given in these courses. Pupils who complete a year in the Supplementary Course are entitled to receive the Merit Certificate, which is the highest certificate obtainable at the Primary School. The new methods of classification will in the near future, no doubt, allow for a greater influx of pupils into these courses. This is one of the problems in the near future, and the provision for pupils entering school at a given period near to their fifth birthday, which is to be found in the new Education Bill, may help to solve it in a very satisfactory way. Until in Scotland pupils enter school uniformly at five years of age, there will always be great difficulty in maintaining the ideal percentage laid down by inspectors.

(*To be continued.*)

# Our Query Column.

SOLUTIONS BY A. CLEMENT JONES, M.A., PH.D., SENIOR MATHEMATICAL MASTER, BRADFORD GRAMMAR SCHOOL.

**RULES.**

1. Each correspondent is restricted to *one* question.
2. Each query must be accompanied by the name and address of the correspondent, and the *coupon* which appears on the back wrapper of the current number of the Journal.
3. CORRESPONDENTS MUST IN ALL CASES STATE THE SOURCE FROM WHICH THEIR QUERY HAS BEEN OBTAINED.

The Editor reserves to himself the right to decline to answer any question which is, in his judgment, unsuited to the Magazine.

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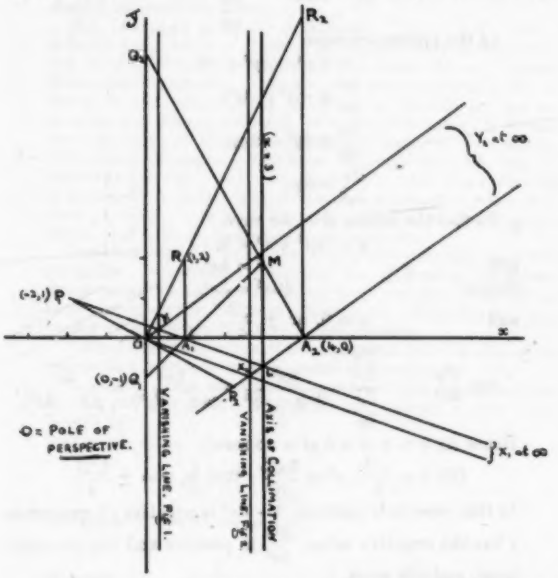
FRANÇOIS.—The pole of perspective of two figures in plane perspective is the origin, the axis of collimation is $x = 3$. The points $A_1$ (1, 0) and $A_2$ (4, 0) are corresponding. Construct the vanishing lines and the triangle $P_2Q_2R_2$ corresponding to $P_1Q_1R_1$, where $P_1$, $Q_1$, $R_1$ are the points $(-2, 1)$, $(0, -1)$, $(1, 2)$ respectively. The co-ordinates are referred to rectangular axes.




*To find the Vanishing Lines.*—There are two vanishing lines, one in the figure $A_1P_1Q_1R_1$...corresponding to the points at infinity in the figure $A_2P_2Q_2R_2$..., and one in the figure $A_2P_2Q_2R_2$...corresponding to the points at infinity in the figure $A_1P_1Q_1R_1$...Two properties must be remembered—

(1) Any point on the axis of perspective or collimation corresponds to itself.

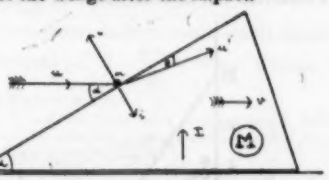
(2) The join of any two corresponding points passes through the pole of perspective—that is, the origin.

Join $P_1A_1$, meeting the axis of collimation at L. Then, since $A_2$ corresponds to $A_1$ and L to itself, the straight line $A_2L$ corresponds to the straight line $A_1L$. Draw a line through O parallel to $A_2L$. This meets $A_2L$ at a point $Y_2$ at infinity, hence the corresponding point to $Y_2$ lies on this line. But it also lies on the line $A_1L$, since this corresponds to $A_2L$, hence $Y_1$ is as shown in the figure. Similarly draw $OX_2$ parallel to $A_1L$ to meet $A_2L$ at $X_2$, then $X_2$ is a point on the vanishing line in the figure $A_2P_2Q_2R_2$...Since the point at infinity on the axis of collimation corresponds to itself, it is on the vanishing lines. These are therefore parallel to the axis of collimation.

*To find the Points corresponding to* $P_1$ $(-2, 1)$, $Q_1$ $(0, -1)$, $R_1$ $(1, 2)$.—Let $OP_1$ meet $A_2L$ in $P_2$. Then since the corresponding point to $P_1$ lies in $OP_1$, and also as $P_1$ lies in $A_1L$, its correspondent lies in $A_2L$. $P_2$ is required point. Let $Q_1A_1$ meet the axis of collimation at M, hence $A_2M$ corresponds to $Q_1A_1M$, hence $Q_2$ lies in $A_2M$ and also in $OQ_1$.

Now $A_1R_1$ is parallel to the axis, and meets it at infinity, hence the corresponding line $A_2R_2$ is parallel to the axis of collimation. $OR_1$ meets this line at $R_2$.

KOKO.—An inelastic ball of mass $m$ is projected horizontally with velocity $u$ against the slanting face of a smooth wedge at rest on a table. If the mass of the wedge be M, and the slanting face slopes at an angle $\alpha$ to the horizontal, determine the initial velocity of the wedge after the impact.




When the ball impinges on the plane there is an impulsive moment, for the velocities are instantaneously changed. The impulse $i$ on the ball is perpendicular to the face of the wedge, since the wedge is smooth. There is a corresponding equal and opposite impulse $i$ on the wedge. At the same time there is an impulse due to the table vertically upwards which destroys the vertical velocity which the wedge would have if it could move freely.

Let $v$ be the horizontal velocity of the wedge immediately after the impulse, and $u'$ that of the particle inclined at an angle $\theta$ to the direction of the slanting face of the wedge. The figure is a vertical section through the particle and a line of greatest slope. There is no impulse perpendicular to this plane, hence we have only to consider the motion in this plane.

First consider the system formed by the particle and the wedge. The resultant impulse on these horizontally is zero, hence there is no change of momentum horizontally. Thus

$$mu = mu' \cos(\alpha - \theta) + Mv. \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

Next consider the particle. There can be no change of velocity in a direction perpendicular to the impulse, hence

$$u \cos\alpha = u' \cos\theta. \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

Lastly, since the body is inelastic, the velocity at the moment of maximum compression is the velocity at the end of the impulsive moment—that is, the velocity of the ball and wedge in the direction of $i$ is the same. This also follows from Newton's rule that the relative velocity in the line of impact after impact is $-e$ times that before, for $e$ is zero. Hence

$$u' \sin\theta = v \sin\alpha. \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

From (1), $mu = mu' \cos\theta \cos\alpha + mu' \sin\theta \sin\alpha + Mv$

$$= mu \cos^2\alpha + mv \sin^2\alpha + Mv.$$

Hence $$v = \frac{mu \sin^2\alpha}{M + m \sin^2\alpha}.$$

I shall be pleased to receive from you solutions to the following examples of a like nature:—

(i) An elastic ball of mass $m$ falls vertically on a smooth inclined plane (angle $\alpha$) of mass M, which rests on a smooth horizontal plane. If the coefficient of elasticity is $e$, and the velocity of the ball just before striking the plane is $u$, find

(*a*) The velocity of the plane after impact.

(*b*) The velocity of the ball after impact.

(*c*) The loss of kinetic energy at the impact.

(ii) An inelastic particle falls vertically upon a smooth wedge of angle $\alpha$, which rests on a horizontal smooth table. Show that after impact the particle will describe a straight line with uniform acceleration, and that its velocity after sliding off the wedge on to the table will be

$$\frac{\sin\alpha \cos\alpha}{1 + n} \sqrt{V^2 + 2ga \frac{(n + 1) \operatorname{cosec}\alpha}{1 + n \sin^2\alpha}},$$

where V is the velocity with which the particle strikes the wedge at a distance $a$ from its foot, and $n$ is the ratio of the mass of the particle to that of the wedge.

*Note.*—In the example you sent the relative velocity of the particle and wedge perpendicular to the wedge was zero.

AVIS.—A light lever, 26 in. long, is hinged at one end to a wall, and carries a weight at the other. It is supported by a string 20 in. long, one end of which is fastened to the middle point of the lever, and the other to a point on the wall 11 in. above the hinge. Find the direction of the reaction at the hinge.

The word *light* indicates that the weight of the rod can be neglected. Three forces then act on the rod—

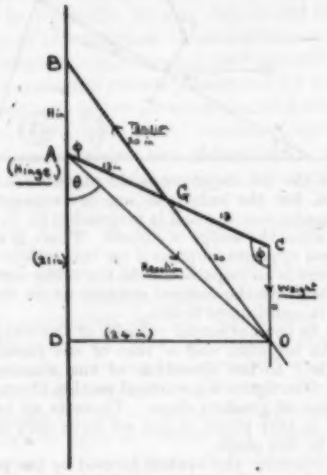
(i) The weight at the end C, which acts vertically downwards through C.

(ii) The tension of the string acting along the string in the direction GB.

(iii) The unknown reaction at the hinge, which must act through the hinge.

Since there are only three forces, these must meet at a point. Let the directions of the forces (i) and (ii) meet at O, then AO is the direction of the reaction.

This direction can be determined in two ways—




(a) Let $\angle OAD = \angle AOC = \theta$,

and $\angle BAC = \angle ACO = \phi$.

Now, since AG = GC and BA is parallel to CO, we have

$$OG = BG = 20 \text{ in.}, \quad OC = AB = 11 \text{ in.}$$

Hence $$\cos\phi = \frac{169 + 121 - 400}{2 \cdot 13 \cdot 11} = -\frac{5}{13},$$

and $$\sin\phi = \sqrt{1 - \cos^2\phi} = \frac{12}{13}.$$

But $$\frac{AC}{\sin AOC} = \frac{OC}{\sin OAC}.$$

Now $\sin OAC = \sin$ (supplement of OAC)

$$= \sin(ACO + COA) = \sin(\theta + \phi);$$

that is, $$\frac{26}{\sin\theta} = \frac{11}{\sin(\theta + \phi)},$$

or $$26\sin\theta\cos\phi + 26\cos\theta\sin\phi = 11\sin\theta;$$

that is, $$-10\sin\theta + 24\cos\theta = 11\sin\theta;$$

that is, $$21\sin\theta = 24\cos\theta,$$

or $$\tan\theta = \frac{24}{21} = \frac{8}{7}.$$

(*b*) *Graphical.*—On a base AB (11 in.) construct the triangle AGB so that AG = 13 in., BG = 20 in. Produce AG to C so that AC = 2AG = 26 in. Through C draw a parallel to BA to meet BG produced in O. Draw OD perpendicular to BA. Measure OD and AD.

We find $$OD = 24, \quad AD = 21,$$

hence $$\tan OAD = \frac{24}{21} = \frac{8}{7}.$$

MATHS.—If $y^4 - xy^3 + x^4 = 0$, find maxima and minima values of $x$ and of $y$. (Stage VI., 1903.)

The method of treating maxima and minima when the variables are connected by an equation is as follows :—

Let $u \equiv y^4 - xy^3 + x^4$.

First consider $y$.

Now $$\frac{dy}{dx} = -\frac{\frac{\partial u}{\partial x}}{\frac{\partial u}{\partial y}};$$

but when $y$ is a maximum or minimum $\frac{dy}{dx} = 0$.

Hence in this case $\frac{\partial u}{\partial x} = 0$.

If we solve then the equations,

$$u = 0, \quad \frac{\partial u}{\partial x} = 0,$$

we get values of $x$ which *may* make $y$ a maximum or minimum. The test for these values is whether they make $\frac{d^2y}{dx^2}$ negative, positive, or zero. Now, since $\frac{\partial u}{\partial x} = 0$, if the value of $\frac{d^2y}{dx^2}$ be found in the usual way, we get

$$\frac{d^2y}{dx^2} = -\frac{\frac{\partial^2 u}{\partial x^2}}{\frac{\partial u}{\partial y}}.$$

In the present exercise

$$u = y^4 - xy^3 + x^4.$$

$$\frac{\partial u}{\partial x} = -y^3 + 4x^3.$$

$$\frac{\partial u}{\partial y} = 4y^3 - 2xy.$$

$$\frac{\partial^2 u}{\partial x^2} = 8x^3.$$

To find the values of $x$, we have

$$y^4 - xy^3 + x^4 = 0,$$

and $$y^3 = 4x^3.$$

Hence $$16x^6 = 3x^4,$$

and $$x = 0, \text{ or } \pm\frac{\sqrt{3}}{4}.$$

But $$\frac{d^2y}{dx^2} = -\frac{\frac{\partial^2 u}{\partial x^2}}{\frac{\partial u}{\partial y}} = \frac{8x^3}{2xy - 4y^3} = \frac{4x^2}{y(x - 2y^2)} = \frac{4x}{y(1 - 8x^2)}.$$

Hence (i) $x = 0$, $y = 0$ give no result.

(ii) $x = \frac{\sqrt{3}}{4}$, $y^3 = \frac{3\sqrt{3}}{16}$; that is, $y = \pm\frac{\sqrt[4]{27}}{4}$.

In this case $4x$ is positive, $1 - 8x^2$ is negative; hence when $y$ has the negative value, $\frac{d^2y}{dx^2}$ is positive and $10y$ is a minimum, and *vice versa*.

$\therefore y = +\frac{\sqrt[4]{27}}{4}$ is a maximum,

$y = -\frac{\sqrt[4]{27}}{4}$ is a minimum.

(iii) $x = -\frac{\sqrt{3}}{4}$, $y$ is imaginary.

Again for maximum and minimum values of $x$.

$$u = y^4 - xy^3 + x^4.$$

$$\frac{\partial u}{\partial y} = 4y^3 - 2xy.$$

$$\frac{\partial u}{\partial x} = -y^3 + 4x^3.$$

$$\frac{\partial^2 u}{\partial y^2} = 12y^2 - 2x.$$

Hence for values required

$$y^4 - xy^3 + x^4 = 0,$$

and $$4y^3 - 2xy = 0.$$

Hence $$y = 0, \text{ or } x = 2y^2,$$

and $$16y^6 = y^4;$$

that is, $$y = \pm\tfrac{1}{4},$$

in which case $$x = \tfrac{1}{8}.$$

But $$\frac{d^2x}{dy^2} = -\frac{\frac{\partial^2 u}{\partial y^2}}{\frac{\partial u}{\partial x}} = \frac{12y^2 - 2x}{y^3 - 4x^3} = \frac{8}{1 - 8x^3}.$$

(1.) If $y = 0$, $x = 0$, and $\frac{d^2x}{dy^2}$ is $+ \infty$, hence $x$ is a minimum.

(2.) If $y = \pm \frac{1}{3}$, $x = \frac{1}{3}$, and $\frac{d^2y}{dx^2}$ is $- \infty$, hence $x$ is a maximum.

Therefore $\frac{1}{3}$ and 0 are the maximum and minimum values of $x$.

Solve similarly

(i) $xy(y - x) = 2a^3$ for $y$.

(ii) $x^4 + 2ax^2y - ay^3 = 0$ for $x$ and $y$.

(iii) If $3y^2 + xy^2 + 4x^3 = 0$, $y$ has a maximum value $- 3$.

HENRI.—The following points in the solution you sent occur to me:—

(1.) You say "divide the rectangle up into similar rectangles." This is much too vague. On what principle is your division carried out?

(2.) The rectangle $(2x \times 2y)$ is apparently not infinitesimal. You, however, take H to be constant at all points on its perimeter, finding thereby a value of H in terms of $x$ and $y$. The $x$ and $y$ are quite indefinite. If H is the value of the magnetic intensity at a point, surely $(x, y)$ should indicate the point.

(3.) You next integrate $\iint H\, dxdy$. The $x$ and $y$ which occur in your value of H have no connection whatever with the co-ordinates of the point $(xy)$, at which $dx \,.\, dy$ is an infinitesimal rectangle. To make this integral intelligible, so far as I can follow your work $(x, y)$ should be the co-ordinates of a point referred to rectangular axes, H should have its value at this point supposed uniform over the infinitesimal rectangle. You then integrate over the area of the rectangle $(2a \times 2b)$. I regret to say that your wording is so indefinite that I cannot attempt to obtain a solution of your problem. One must have all the data, the assumptions made, and definite meanings to symbols used.

Double integrals, when the limits are constants and the variables independent, present no difficulty whatever. Some complications arise when they are not independent in determining the limits of integration. Here is a solution to the question you mention in Williamson.

"Find the mean value of the square of the distance of all points in a square from the centre of the square."

Take two lines through the centre of the square parallel to the sides as axes of co-ordinates, and let a side be of length $2a$.

The mean value

$$= \frac{1}{4a^2} \int_{-a}^{a} \int_{-a}^{a} (x^2 + y^2) dxdy.$$

Integrate first with respect to $y$.

$$\text{Integral} = \frac{1}{4a^2} \int_{-a}^{a} \left[ x^2y + \frac{y^3}{3} \right]_{-a}^{a} dx$$

$$= \frac{1}{4a^2} \int_{-a}^{a} \left( 2ax^2 + \frac{2a^3}{3} \right) dx$$

$$= \frac{1}{4a^2} \left[ \frac{2ax^3}{3} + \frac{2a^3x}{3} \right]_{-a}^{a} = \frac{1}{4a^2} \cdot \frac{8a^4}{3} = \frac{2a^2}{3}.$$

You would do well to work out a number of double integrals from Williamson, and I shall be glad to give you assistance with any difficulties. I do not at present know any collection of examples in Spherical Harmonics, but will try to find you one.

TIM.—If the common ratio of a geometrical series is but a little greater than unity, show that the sum of the first $n$ terms differs but little from $n$ times the arithmetic mean of the first and last terms. (Stage III., 1907.)

Let the first term of the geometrical series be $a$ and the common ratio $r$.

We are given that $r = 1 + x$, where $x$ is a small quantity. Since $x$ is small, higher powers of $x$ will rapidly become very small. We will therefore obtain the two quantities to be compared in the form of series in ascending powers of $x$.

The sum of $n$ terms $= \frac{a(r^n - 1)}{r - 1}$

$$= \frac{a}{x} \left\{ (1 + x)^n - 1 \right\}$$

$$= \frac{a}{x} \left\{ 1 + nx + \frac{n(n-1)}{1.2} x^2 + \frac{n(n-1)(n-2)}{1.2.3} x^3 + \ldots\ldots - 1 \right\}$$

$$= a \left\{ n + \frac{n(n-1)}{2} x + \frac{n(n-1)(n-2)}{6} x^2 + \ldots\ldots \right\}.$$

Again, $n$ times the arithmetic mean of the first and last term

$$= \frac{n}{2} \left\{ a + ar^{n-1} \right\}$$

$$= \frac{na}{2} \left\{ 1 + (1 + x)^{n-1} \right\}$$

$$= \frac{na}{2} \left\{ 1 + 1 + (n-1)x + \frac{(n-1)(n-2)}{1.2} x^2 + \frac{(n-1)(n-2)(n-3)}{1.2.3} x^3 + \ldots\ldots \right\}$$

$$= a \left\{ n + \frac{n(n-1)}{2} x + \frac{n(n-1)(n-2)}{4} x^2 + \ldots\ldots \right\}.$$

The first two terms in each result are the same, hence the difference is equal to $\frac{n(n-1)(n-2)}{12} ax^2$ + terms which contain $x^3$ and higher powers.

If then $x$ is a small quantity, the required difference is of the second order of small quantities provided the number of terms $(n)$ taken is not large.

## HOLIDAY COURSES AT GRENOBLE.

WE have received the syllabus of the holiday courses in French Language and Literature at Grenoble. Last year these courses were attended by 589 students—a gratifying result, due in no small measure to the energy of the university authorities and the excellent teaching they provide.

Alone among French universities, Grenoble has created an Institute of Phonetics, which offers to intending students a complete cycle of phonetic studies, ranging from the practical teaching of the pronunciation to beginners to a scientific study of the apparatus of speech for teachers. In addition to a course in experimental phonetics, there are practical exercises in reading and speaking. The former take place three or five times a week with groups of six students, and the latter twice a week with groups of four.

For the theoretical teaching of French, students have the option of a *dogmatic* course for those who wish rapidly to acquire a practical acquaintance with the language, or a *historic* course for those whose studies go deeper. The study of French literature includes a review of the historical development of the various forms of literary effort, and a special study of some of the best authors.

Students who desire to carry off certificates with them may obtain a Certificate of Industry, which specifies the courses they have followed; or if they have followed the holiday courses for two months, they may present themselves for a written and oral examination and obtain the Certificate of French Studies. A medal is given to the student who does best in this examination.

On Saturdays and Sundays there are no classes, and excursions are organised into the picturesque surroundings of Grenoble, or to such interesting places as Nîmes, Arles, Lyons, Geneva, Marseilles, etc. The railway companies offer important reductions of tariffs to students anxious to visit points of interest from Grenoble. Living is cheap in Grenoble, and university fees are very moderate. These range from 50 francs for six weeks' teaching to 80 francs for four months. Board and lodging range from 110 to 150 francs per month, but students may even get comfortable accommodation for as little as 100 francs a month. The Committee of Patronage of Foreign Students has also secured another great advantage. The Paris-Lyons-Mediterranean Railway grants return tickets from Paris to Grenoble at half price to English and American students following the holiday courses. To secure this boon, intending students must write in good time to M. Marcel Reymond, University of Grenoble.

VISITORS to Morecambe should ask at Messrs. Nelson's Stall to see

"PREPARATORY MATHEMATICS,"

By JONES and BLOMFIELD.

# N.U.T. CONFERENCE, 1909.

## WHAT MAY HAPPEN AT MORECAMBE.

BY ALLEN CROFT.

*The Opening Day.*

CONFERENCE business is timed to begin at 10 a.m. on Easter Monday, but I honestly admit that I regard the day's arrangements with the utmost misgiving. Until the year 1902—my own Presidential year, by the way—Conference assembled on Easter Monday afternoon, and there were crowded into one session the Public Reception by the local bigwigs, the Reception of Deputations, the President's Address, and a variety of other matters, which sometimes made the session of inordinate length—one, I remember, exceeding four hours.

Representatives became utterly weary, and as a consequence there was something resembling want of proper courtesy to our guests from overseas, whilst the unfortunate President had to read his address to an audience which became "small by degrees, and beautifully less." The difficulty was solved for seven years by dividing the business into two parts, taking half in the morning and reserving the afternoon session for the President's address—a plan which, in my judgment, always seemed to work admirably. The exchange of courtesies in the morning was an agreeable and pleasant function, whilst the President was assured of an attentive and sympathetic audience.

At Morecambe everything which has hitherto been sufficient for two whole sessions is to be crammed into one long morning session, in order that the afternoon may be utilised for a two hours and a half "private session"—a proceeding likely to cause weariness, and possibly want of good-humoured toleration, from the very outset. I know, of course, something of the difficulties attending the work of the Finance Committee of the Executive in making Conference arrangements, yet, without much fear of the possibility of being dubbed a false prophet, I dare hazard the opinion that the Easter Monday's programme at Morecambe will not speedily be repeated.

The Mayors of Morecambe and Lancaster and the Bishop of Manchester appear to be the most important personages at the Public Reception; and probably particular interest will attach to the utterances of the venerable Dr. Knox, whom I remember addressing the Birmingham Class Teachers' Conference, away back in '94, in quite inimitable style.

The thanks to the retiring President will be voiced by Messrs. Bentliff and Folland, his two colleagues from South London, who are happy in having so exceptional an object for their panegyrics as Mr. W. A. Nicholls, who is the second class-master to wear the blue ribbon of the Union, and who has added distinction and dignity to his high office. Mr. Nicholls will install as his successor another London teacher, Mr. C. W. Hole, a gentleman his very antithesis in manner and temperament, yet a man worthy in every respect of the position which he will this year adorn.

After the President's address, a round dozen "foreign" deputations will voice the felicitations of the organisations which they represent; and the session, already far too long, will terminate with a presentation to Mr. and Mrs. George Sharples, in the presence of an audience totally unworthy of the estimable couple and the occasion.

* * *

*Tuesday Morning.*

THERE is invariably a full attendance on Tuesday morning, when the first business is the declaration of the results of the election to the Executive—a matter to which I refer later on in these "Notes." Then follows the choice of the place for the next Conference; and this year the decision cannot be easily foretold, seeing that there are no less than six invitations before us, from towns with such varied attractions as Aberystwyth, Cardiff, Carnarvon, Cheltenham, Lincoln, and Plymouth. My personal sympathies lean, at present, towards Aberystwyth and Plymouth, and no doubt the contest will be a keen one.

The Conference agenda is now arranged by a plebiscite of the Local Associations, though power is reserved to the Executive to select the *first* resolution at each public session. This year its subject is "Imperial Grants for Education," and none will be found to gainsay its urgent and paramount importance. When we recollect how matters like the feeding of school children and medical inspection have been thrust upon the Local Education Authorities without the contribution of a single farthing from State sources towards their cost, and when we recollect, in addition, how great provincial Authorities like those of Leeds and Bradford are threatening to withhold all increments of salary, we realise that the time has come for demanding the million and a half which was promised by the Chancellor of the Exchequer in connection with both Mr. M'Kenna's and Mr. Runciman's Bills. The Executive's resolution is in the capable hands of Mr. A. R. Pickles, M.A., a brilliant ex-President of the Union, who has made this subject his special study, and who has the Gladstonian power of giving life and vitality even to a mass of figures. His seconder is Mr. Rhys Nicholas, one of the ablest of the recent additions to the Executive, who possesses brains in addition to the fluency so characteristic of his countrymen.

Further resolutions will be submitted on (1) "Qualifications of Teachers," when Mr. W. D. Bentliff (one of the clearest thinkers and speakers on the Executive) will make use of the opportunity of bringing before Conference the reforms recently demanded from the President of the Board of Education; (2) "Compensation for Loss of Employment," when "a coming President" in Mr. Frank Goldstone will ask Conference to declare that where teachers are thrown out of employment "through the operation of the Appropriation Act, or through the compulsory closing of schools, they should be either transferred to other schools under the control of the Local Education Authority, or adequately compensated;" and (3) "Attendance at School," in which two Ipswich representatives will have an early chance of showing their capabilities.

* * *

*Sectional Meetings.*

THE (Public) Sectional Meetings, of which there are two only this year, do not, *on paper*, compare at all favourably with the four held at Hastings, where it was my personal good fortune to preside over the "Literature in Schools" section, rendered memorable by the really brilliant paper of Mr. J. E. Barton, M.A., headmaster of the Crypt Grammar School, Gloucester. Perhaps my development may be a little lopsided, for I confess, with no sense of shame, that whilst sectional meetings are retained, I would make "Literature in Schools" an *annual* subject, so greatly do I realise its potentialities in the case of young children.

I do not for one moment wish to dispute the importance of either "Leaving Examinations and Scholarship Competitions," concerning which Mr. A. R. Pickles, M.A., will doubtless have something pungent and courageous to say, or of "The Teaching of Handicrafts in Schools," on which Mr. C. Bird, an "expert" from Leicester, will assuredly read an excellent paper. Both subjects are very much in evidence just now, and my own hope is that both the West End Chapel and Devonshire Hall will be crowded to the doors, and that interesting and lively discussions may follow. Last year, at my own section, so many visitors expressed their desire to speak, and so instructive and thought-provoking was the debate, that with one accord we gladly extended the session half an hour beyond the original time allotted.

The chairmen of the sections this year are Mr. F. C. Blackburn, the sturdy and fearless chairman of the Executive's Finance Committee, and Mr. Harry Pearson, this year's President of the N.F.A.T., and both gentlemen are thoroughly deserving of the distinction.

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*Thursday Morning.*

NO better subject educationally could be selected for the opening of a public session than the "Size of Classes"—a topic on which most teachers can be eloquent, or eloquently silent. For a generation almost the N.U.T. has been endeavouring to secure for the children the best education possible in the primary schools, calling with equal vigour both for a larger proportion of trained certificated teachers and a reduction in the size of classes. Had the Executive been merely worldly-wise, they could have taken up the attitude that, until the parents of the children were more zealous in securing golden opportunities for their offspring and the Local Education Authorities more determined and persistent in their demand for larger Imperial grants for education, their policy was to "lie low;" for such reforms as were introduced would, in all probability, be effected at the expense, sooner or later, of the teachers themselves. But to its glory the Union has always placed the child first; and so we shall witness once again a denunciation of the miserable staffing regulations of Article 12 (*a*) of the Code, and a demand for classes of reasonable size.

Mr. A. W. Dakers, B.A., will introduce the question, and, I have little doubt, will add to his already high reputation. Sometimes at the Executive Mr. Dakers speaks with such force and eloquence that he seems destined for the highest honours at the disposal of his fellow-teachers. He is what I should term an absolutely "straight" man, with plenty of grit and courage and a pertinacity worthy of Marshall Jackman. His seconder is Mr. Flavell, a man of singular ability and foresight, who is never afraid to take an unpopular side, and who never speaks without having carefully considered a question from every point of view.

Many of us regretted his early withdrawal from the contest for Vice-Presidential honours.

"Provision of Meals" will follow "Size of Classes," and Mr. Frank Goldstone, to whom I have already referred, will put both pathos and common sense into all he cares to say on the topic. "Staffing of Schools" and "Training of Teachers" come next, and it is just possible that my excellent friend, Mr. J. T. Boulter, will be afforded the opportunity to make his annual speech on "Size of Departments." His seconder is Miss Cleghorn, the estimable lady from Sheffield, whose attack on the Vice-Presidency is being supported in influential quarters in many parts of the country.

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*Private Sessions.*

I MAY as well acknowledge straight away that I do not particularly like "private sessions," nor am I at all alone in this respect. Somehow or other these private sessions, which ought to be of real and genuine service to the Union as a whole, are largely frittered away in peddling little attacks on the personal honour of members of the Executive. Whenever we go about the country on Union business, and wherever we go, we are treated with what appears to be the most genuine kindness, courtesy, and cordiality; and I might, on occasion, make use of even stronger terms. When we appear in the streets of the Conference towns or at any of the multitudinous little "side-shows," the same spirit of friendliness and good-fellowship is evident. But go to a "private session," and the whole spirit of relationship seems somehow changed. And really I can't tell why. Some ten years ago officials euphemistically described as "examiners of accounts" were chosen by Conference to discover, if they could, any improper use of the Union's funds. I cannot recall to mind their having done so; but what they *did* unearth was the fact that the personal expenses of members of the Executive varied when on Union business. Parenthetically, I may state that it would have been strange had their charges *not* varied, seeing that many of us consider it our duty to stay at "headquarters" when the charge *per diem* is anything over half a guinea, whereas others seem to prefer the comparative privacy of a boarding-house, with its *pension* of a few shillings.

To put an end to bickerings which were rapidly driving from Conference many of the best spirits in the Union, a fixed scale was introduced; and last year, at Hastings, so far as I could understand the pother, the trouble was because members utilised the scale prescribed for their guidance by Conference! I think it was at Portsmouth that I told the Conference that before very long it would be difficult to find a man with any vestige of self-respect willing to serve his fellow-teachers at all; and I make this earnest appeal to any *Practical Teacher* readers who may be delegates to Morecambe to show, with no uncertain sound, their opinion that this *régime* of suspicion and innuendo must cease.

There are *three* private sessions this year, and if the usual waste of a session and a half on the balance sheet and its appurtenances can be avoided, then much useful work may be accomplished; for large questions of reorganisation, professionalism, reform of constitution, subscription, etc., occupy the best places on the agenda.

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*The Executive's Report.*

THE first private session invariably opens with the motion "that the annual report of the Executive be received and adopted and printed for circulation;" and, according to custom, this motion is entrusted to the retiring President, who is supposed to be acquainted with every phase of Union work. The report is, I think, the lengthiest of its kind I have ever seen; but inasmuch as this represents successful *work* of a kind whose ramifications become inevitably wider each year, this is all to the good.

Possibly the paragraph in the report which will evoke the keenest discussion is the recommendation that "the salary of the secretary to the Examinations Board be advanced to a maximum of £350 by annual increments of £25, the first increment to date from January 1, 1909." Mr. Hollingsworth has been an exemplary official, who has worked night and day (and I once heard a whisper of "Sundays") himself in order to attempt the Sisyphean task of wiping off the huge adverse balance on the Examinations Board account. This is a branch of Union activity which can never be profitable, but which is genuinely educational, and one that has gone far in the direction of making our organisation respected amongst Local Education Authorities. My one fear is that some of the iconoclasts of Conference—falsely described as "ultra-economists"—will not discuss the recommendation of the Executive *re* Mr. Hollingsworth, but make a further attempt to terminate the Board's existence.

*Mr. G. J. Rankilor's Retirement.*

THE Nestor of the Executive, the kind and genial George J. Rankilor, having announced his decision to retire, Conference will be invited to present to him a cheque for one hundred guineas "in recognition of his valuable services to the Union." Mr. Rankilor was, of course, President of the Union when I was a small boy, but he reappeared at the Executive at a time when there were often the most unpleasant "relations" between the old "Board" and "voluntary" teachers. I ascribe the absolute cessation of discord to his marvellous influence, and with whole-hearted approval I venture to quote these words from the Executive's eulogium: "Mr. Rankilor's earnest, devoted, and cheerful services to the cause of the schools and the teachers have been long, efficient, and invaluable, and he has the affectionate esteem of all who know him."

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*The Union's Subscription.*

ALTHOUGH the Executive have tabled the motion, "That the 9s. subscription to the Union be increased to 12s. per annum; that of such increase 2s. 6d. be devoted to professional sustentation and 6d. to the General Fund; and that the Executive be empowered to make the necessary alteration of rules to give effect to this decision," it is significant and ominous that the following resolution from Lewisham, "*No further increase shall be made in the subscription to the N.U.T. until the individual members have had an opportunity of voting on the question,*" has obtained the first place. I am aware, of course, of the existence of a large body of opinion *against* all increases of the Union subscription, but I do sincerely trust that the above resolution will be ignominiously defeated. *Otherwise there will never be any increase at all*, and members of the Union will have to be prepared to see their contracts disregarded, their annual increments shamelessly withheld, and any kind of dishonourable conditions of service thrust upon them. If the Conference is *really* representative of the members of the Union, it must take the responsibility of settling its policy. I have a sort of opinion that the battle-cry of "LEEDS!" following our long struggle in West Ham ought to make short work of this specious-looking *plebiscitum* proposal.

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*Election of Executive.*

I AM sorry that the only motion under this head on the arranged agenda is the silly proposal to give an extra member to the constituencies represented by officers of the Union. There are resolutions dealing with big principles in the comfortable seclusion of the "supplementary" agenda, and I trust that an effort will be made to secure a discussion of the present "electoral districts" method of election. Personally, I would have *two* districts only—(1) London, and (2) Provinces. It is passing strange that this district scheme has caused the disappearance from the Executive of several of its leading protagonists, and under it have been rejected men like Robert Wild, Richard Waddington, and Marshall Jackman, whose names are "household words" throughout the Union.

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*This Year's Elections.*

FOR the Vice-Presidency, Mr. Marshall Jackman will doubtless be returned by a majority which will more than console him for his temporary absence from the counsels of the Union's Cabinet, whilst Miss Cleghorn will receive so large a measure of support that she will be encouraged to continue her candidature for a second year.

For the Executive, I think no change likely in the representation of North England, Lancashire, Yorkshire, East Anglia, South England, West England, North London, and East London, but it is difficult to foretell with any confidence the results in the remaining constituencies.

In the North Midlands, Mr. R. N. Lewis (whom we have sorely missed all the year) is likely to displace either Mr. Baddeley or (*mirabile dictu!*) the writer of this paragraph. Mr. Frank Taylor will probably step into the position vacated by the genial Birmingham veteran in the South Midlands; whilst one of the present admirable Welsh members will have to make room for Mr. Tom John, whose term as an ex-President now expires. The most difficult nut to crack is South London, and what will happen here may depend largely on the line Conference takes on the alteration of rule referred to in the preceding paragraph.

Easter Tuesday will dawn, fraught with fate, for some forty anxious individuals and their scores of enthusiastic followers.

# MODERN SCIENCE NOTES.

BY J. G. M'INTOSH, SECONDARY SCHOOL, GATESHEAD.

## The Wright Aeroplane.

THE following description and the accompanying illustrations are taken from the specification and drawings filed with Wright Brothers' application for patent in the United States Patent Office.

Fig 1 is a perspective view of the apparatus. Fig. 2 is a plan view, showing parts broken away to expose those beneath. Fig. 3 is a side elevation of the apparatus. The aeroplanes 1 and 2 are superposed, and each of them is considerably greater in width from side to side than from front to rear. Each aeroplane is formed by stretching cloth or other suitable fabric over

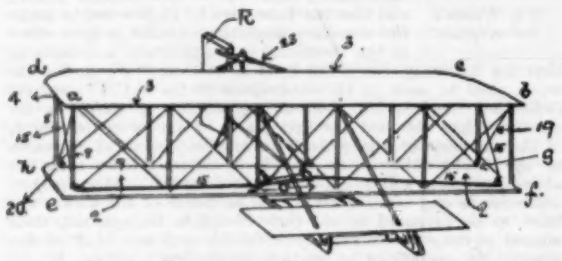

Fig. 1.—Perspective View of Aeroplane.

a frame composed of two parallel transverse spars, 3, extending from side to side of the machine, their ends being connected by bows, 4, extending from front to rear of the machine. The front and rear spars, 3, of each aeroplane are connected by a series of parallel ribs, 5, which preferably extend from the rear spar, as shown. The cloth for the aeroplane is cut on the bias, and made up into a single piece, approximately the size and shape of the aeroplane, having the threads of the fabric arranged diagonally to the transverse spars and longitudinal ribs; thus the diagonal threads of the cloth form truss systems with the spars and ribs, the threads constituting the diagonal members. A hem is formed at the rear edge of the cloth to receive a wire, which is connected to the end of the rear spar, and supported by the rearwardly-extending ends of the longitudinal

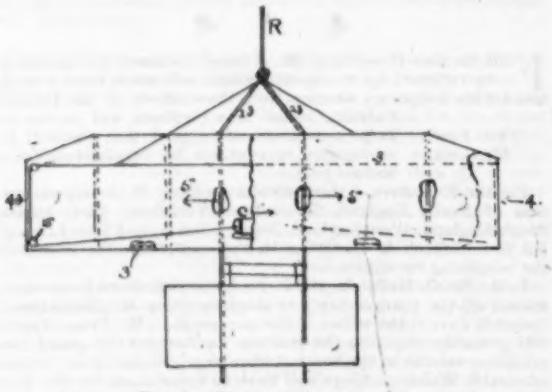

Fig. 2.—Plan of Aeroplane.

ribs, 5, thus forming a flap or portion of the aeroplane. This construction of the aeroplane gives a surface which has very great strength to withstand lateral and longitudinal strains, at the same time being bent or twisted in the manner hereinafter described.

Considering the structure so far as we have now described it, and assuming that the cradle *c* be moved to the right in Figs. 1 and 2, as indicated by the arrows applied to the cradle in Fig. 1 and by the dotted lines in Fig. 2, it will be seen that that portion of the rope 15 passing under the guide-pulley at the corner *e* and secured to the corner *d* will be under tension, while slack is paid out throughout the other side or half of the rope 15. The part of the rope 15 under tension exercises a downward pull upon the rear upper corner *d* of the structure and an upward pull upon the front lower corner *e*, as indicated by the arrows. This causes the corner *d* to move downward and the corner *e* to move upward. As the corner *e* moves upward it carries the corner *a* upward with it, since the intermediate standard 8 is substantially rigid, and maintains an equal distance between the corners *a* and *e* at all times. Similarly, the standard 8, connecting the corners *d* and *h*, causes the corner *h* to move downward in unison with the corner *d*. Since the corner *a* thus moves upward and the corner *h* moves downward, that portion of the rope 19 connected to the corner *a* will be pulled upward through the pulley 20 at the corner *h*, and the pull thus exerted on the rope 19 will pull the corner *b* on the other side of the machine downward, and at the same time pull the corner *g* at said other side of the machine upward. This results in a downward movement of the corner *b* and an upward movement of the corner *c*. Thus it results from a lateral movement of the cradle 18 to the right in Fig. 1 that the lateral margins *ad* and *eh* at one side of the machine are moved from their normal

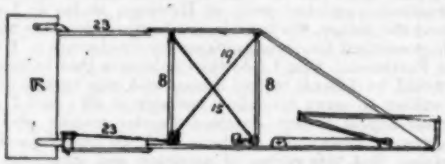

Fig. 3.—Side Elevation.

positions, in which they lie in the normal planes of their respective aeroplanes, into angular relations with said normal planes, each lateral margin on this side of the machine being raised above said normal plane at its former end, and depressed below said normal plane at its rear end, said lateral margins being thus inclined upward and forward. At the same time a reverse inclination is imparted to the lateral margins *bc* and *fg* at the other side of the machine, their inclination being downward and forward. A movement of the cradle 18 in the opposite direction from its normal position will reverse the angular inclination of the lateral margins of the aeroplanes in an obvious manner. By reason of this construction it will be seen that with the particular mode of construction now under consideration it is possible to move the forward corner of the lateral edges of the aeroplane on one side of the machine either above or below the normal planes of the aeroplanes, a reverse movement of the forward corners of the lateral margins on the other side of the machine occurring simultaneously. During this operation each aeroplane is twisted or distorted around a line extending centrally across the same from the middle of one lateral margin to the middle of the other lateral margin, the twist due to the moving of the lateral margins to different angles extending across each aeroplane from side to side, so

that each aeroplane surface is given a helicoidal warp or twist.

In connection with the body of the machine, as thus operated, is a vertical rudder or tail, R, so supported as to turn around a vertical axis. This rudder is supported at the rear ends of supports or arms, 23, pivoted at their forward ends to the rear margins of the upper and lower aeroplanes respectively. These supports are preferably V-shaped, as shown, so that their forward ends are comparatively widely separated, their pivots being indicated at 24. They are free to swing upward at their free rear ends, as indicated in dotted lines in Fig. 3, their downward movement being limited in any suitable manner.

Contrary to the usual custom, the horizontal rudder in front of the aeroplanes is arranged at a negative angle, and no horizontal tail is used. By this arrangement a forward surface is obtained which is almost entirely free from pressure under ordinary conditions of flight, but which, even if not moved at all from its original position, becomes an efficient lifting-surface whenever the speed of the machine is accidentally reduced very much below the normal, and thus largely counteracts that backward travel of the centre of pressure on the aeroplanes which has frequently been productive of serious injuries by causing the machine to turn downward, forward, and strike the ground head-on.

### The "Latest" from Chicago.

During the past few weeks we have had marvellous accounts of a new discovery by a Dr. Bailey of Chicago, to which has been given the name of "radiothor." This substance he claims to have isolated from Colorado pitch-blende. It has, we are told, all the curative properties of radium, with none of its dangerous after effects; can be manufactured cheaply; cures cancer, locomotor ataxy, and all the ills that flesh is heir to. It becomes "luminous" when placed in contact with the —ve pole of a magnet, and changes common glass into the colours of Bohemian glass. It can be manufactured cheaply, and doubtless we shall see it retailed shortly in the Strand at a "penny a packet."

Professor Soddy, in the issue of *Nature* (March 9), does a public service in calling attention to the real "radio-thorium," first isolated by Otto Hahn from thorianite, and independently separated later from the hot springs of Baden-Baden. Its period of half change is two years, and it gives $\alpha$ rays.

The first product of thorium to be separated was thorium X, of a period four days. It is a product of radio-thorium, but until the present time no chemical means of separating them is known.

Professor Soddy also makes a valuable suggestion. There is, he points out, an intermediate body produced from thorium, and in its turn producing radio-thorium. This body is known as meso-thorium. It has a period which is estimated at seven years, and give $\beta$ rays only. It can readily be obtained when thorium is precipitated with ammonia, going with thorium X, and leaving the radio-thorium with the thorium. In the course of a few years the radio-thorium changes, leaving thorium alone, while the meso-thorium grows new radio-thorium.

It is suggested that this meso-thorium might be utilised, and prove a cheap substitute for radium in many cases.

Thorium salts are manufactured commercially in large quantities at the present time; the readily separated meso-thorium plays no part in the commercial applications of thorium. It might be separated without appreciable waste, and in the course of time its product, radio-thorium, could be used.

### Radium in Surgery.

In a lecture at the London Hospital on "Radium in Surgery" Sir Frederick Treves gave many interesting facts regarding its applications to medical science. It has been tried with success in cases of rodent ulcers of many years' standing, and proved successful where the Finsen light and Röntgen rays have failed. Applied on varnished silk, it almost immediately removed the itching of eczema. The successful use of radium depends largely on the extent of surface required—a little radium spread over a large surface being more efficacious than a solid bead. In Paris, Dr. Domenici has used plates of various sizes and forms spread with radium of quarter strength, and in this way has gauged the power. For each patient a proper prescription has to be drawn up. A plate of a certain size is ordered, the proportions of $\alpha$ and $\beta$ rays prescribed, the distance at which the plate is to be held, and the time of its application regulated. Sir Frederick Treves is of the opinion that the future of radium in surgery depends on its emanations.

A mouse into which abdominal cancer had been introduced was injected with a solution of deposit from the emanation, and the cancer disappeared. In one of his own patients each injection produced a scar and skin pigmentation quite strange in his experience as a surgeon.

In future investigations on the therapeutic action of radium it will be essential to ascertain the effects on bacteria and their products. The selective action must be investigated, particularly its power on embryonic tissue.

## HOLIDAY COURSES ON THE CONTINENT FOR INSTRUCTION IN MODERN LANGUAGES.

The Board of Education have just published a list of thirty Holiday Courses which will be held on the Continent at different times during the present year, but mostly in the summer months. Seven of the courses are in German-speaking countries—namely, at Greifswald, Jena, Marburg, Neuwied, Lübeck, Kaiserslautern, and Salzburg; three in French Switzerland, at Geneva, Lausanne, and Neuchâtel; one in Spain, at Santander; one in Italy, at Florence; and the rest in France, at Besançon, Dijon, Grenoble, Nancy, Boulogne-sur-Mer, St. Servan, St. Malo, Paris, Versailles, St. Valery-sur-Somme, Tours, Honfleur, Bayeux, Granville, Caen, Lisieux, and Villerville. The table published by the Board of Education gives the date of each course, the fees, return fares from London, lowest cost of boarding, principal subjects of instruction, address of Local Secretary, and other details of importance to intending students. Copies of the table (price 2d.) can be obtained direct from Messrs. Wyman and Sons, Limited, Fetter Lane, London, E.C., or through any bookseller.

AT MORECAMBE

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# Our Readers' Column.

## STUDIES OF BOOKS THAT ARE WORTH WHILE.

BY SUSAN CUNNINGTON.

*II.—The Novels of Charles Kingsley* (1850–66).

"Still the race of hero-spirits
Pass the lamp from hand to hand;
Age from age the words inherits—
Wife and child and Fatherland."

TWO kinds of fiction which appeal to very different tastes are described as "historical novels" and "novels with a purpose," and the contributions of Charles Kingsley to creative literature belong to these two classes. In the early years of the reign of Queen Victoria, Lord Lytton was the principal writer of historical novels, and the "novel of manners," as works dealing with contemporary life are sometimes called, was beginning to be concerned with the movements and questions of the time. The great name of Dickens is one which we connect with this development in fiction, though the largeness of his method and the number and variety of the characters in each story prevent the "purpose" being so apparent as in the books of some other writers.

Charles Kingsley adopted the novel as the best form in which to make appeal to the moral sense of the general public, and to arouse action against the evil conditions under which Englishmen and Englishwomen had to live. In *Yeast* he dealt with the hardships of country life, and the painful features which accompanied the transition of England from the position of an agricultural country to that of a manufacturing one. In *Alton Locke* he showed the miseries of the "sweated" worker in towns.

We are so familiar at the present time with the expression "sweated industries" that young and ardent reformers hardly realise how long standing is the evil they seek to combat, and what an amount of apparently fruitless toil and energy has been devoted to the task of mending those evil conditions. Perhaps the greatest gain to which we can point in the half century which has passed since Kingsley wrote *Alton Locke* is the awakening of a sense of responsibility, and the creation of a sensitiveness to the reproach which such a state of things conveys, in the public mind. When *Yeast* and *Alton Locke* appeared there was only a general and complacent ignorance and an obstinate refusal to understand.

In studying the literature of the Victorian age it is continually evident how close is the connection between that literature and the history of the time. Mrs. Browning's *Cry of the Children*, Hood's *Song of the Shirt*, Mrs. Gaskell's *Mary Barton*, Charles Reade's *It is Never too Late to Mend*, all speak of different disturbing phases of life which occupied a large place in men's minds.

When Charles Kingsley, "the breezy knight of Christian Socialism," as he has been called, joined with the great preacher and theologian, Frederick Denison Maurice, in insisting upon the need for social reform as part of Christianity, he incurred much disfavour. Under the pseudonym of "Parson Lot," he wrote in a series of *Tracts on Christian Socialism*; and in the new periodical, *Fraser's Magazine*, appeared his painful story, *Yeast*. This book and *Alton Locke* vividly portray the England of the "hungry 'forties." A succession of great wars had impoverished the country; bad harvests meant starving labourers; the rapid introduction of machinery increased the wealth of some individuals, but left large numbers in biting poverty; emigration was undertaken, not in high-hearted hope, but in bitterness and indignation; the towns were crowded with a wretched population, who, "in want, in terror, and with a sense of crushing injustice, cursed the land in which they had been born."

The Chartist agitation seemed to threaten something of the Revolution just accomplished in France, and the authorities and the governing classes used the sternest measures to repress it. When the great demonstration and march to Westminster, to present a monster petition to Parliament, passed off peaceably, the friends of the movement set themselves to do what might be done to accomplish some reforms. A small weekly paper, *Politics for the People*, was started; night schools and co-operative associations were founded; the newly-formed societies, to be known later as trade unions, for the protection of workers, were aided and strengthened; and the eloquent pleading of Kingsley's indignant portraiture and descriptions in *Alton Locke* moved many to pause and think. Fierce was the opposition which it encountered, and bitter the criticism; the reading public of those days consisted mostly of those who saw only danger in the discontents and aspirations of the poor. As we read the book now, we find here and there mention of things and doings which remind us of the time that has passed since it was written, but most of the conditions are passably like those of to-day.

In considering the matter of this book, we see that it is a relation intended to move, to shock, not to entertain. The aim and purpose of proclaiming the injustice of the social system in which such lives are possible stand first; the weaving together of the various threads of the story is shown to be comparatively unimportant. In considering the manner, we recognize the force and enthusiasm which sweep us along, and the resolute handling of character and events in a plain and straightforward way. We saw that in *Adam Bede* the outward circumstances and conditions were but the background for the author's presentation of the development of the characters and motives of the persons in the story. In *Alton Locke* the environment is much more than this: men and women are shown to be the victims of circumstances, but it is shown that the responsibility for those crushing circumstances must be accepted by others than the victims.

*(To be continued.)*

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***NOTICE.***

THE Editor greatly regrets the necessity for holding over the remainder of Miss Cunnington's paper, which will be given next month.

# THE PRAISE OF FAMOUS MEN.

BY ALBERT E. ROBERTS, M.A.

LAST month the writer gave an outline of the possibilities of the school anniversary—how interest in history and literature might be enhanced by the celebrations of great national events. It is his purpose in this paper to suggest some of the lines along which a teacher may proceed to commemorate in suitable manner the centenaries of the distinguished dead.

The suggestions here given relate in particular to the centenary commemoration of Lord Tennyson (born August 6, 1809). He is taken as a type, since he would appeal most to the interest and imagination of the children alike of our elementary and secondary schools. It may be left to the teacher to choose whether or no by following these suggestions where possible he shall do reverence in similar manner to the memory of the other eminent writers who were born in the same year. For the sake of convenience it may be appropriate to repeat their birthdays here :—

Lord Houghton, born June 19; Alexander William Kinglake, traveller and historian, born August 5; Edgar Allan Poe, poet and novelist, born January 19; Oliver Wendell Holmes, poet and essayist, born August 29; Edward Fitzgerald, born March 31; Charles Darwin, born February 13; Abraham Lincoln, born February 12; Gladstone, born December 29; Mendelssohn, born February 3; Chopin,* born February 8 or March 1.

The teacher who is a student of literature will not fail to do honour to these great minds by making frequent reference to them and their work during this remarkable year.

Let us first deal with the centenary of Tennyson. It would be advisable to bring the anniversary itself prominently to the notice of the children some considerable time before the day appointed for its commemoration. A day towards the end of the summer term will have to be chosen, since the anniversary falls in the holidays. The school notice-board can be utilised in our elementary schools. Some Local Authorities supply to their schools a calendar consisting of a board on which are fixed daily printed sheets, announcing some important historical event that occurred on that particular day.

The following is the type of notice affixed : "January 21, 1265, Simon de Montfort's Parliament. Members returned to town." Such facts appear to me to be absolutely useless. The daily change, moreover, becomes more or less monotonous, and produces eventually a lack of interest, the utility of the school calendar being thus destroyed. It would be far better to post on the board only a few notices in the year, and those of great and important national events.

Affix, then, to the school notice-board a prominent notice of the coming celebration. On the same board affix also a picture or photograph of Tennyson, which can be easily attained—for example, *Daily Chronicle*, January 20, or Perry Picture Company, Malden, Mass., U.S.A. (halfpenny each). In addition the teacher should draw up a list of books relating to Tennyson and his works which may be obtained in the school library or in the local library. The object of this would be to enable the children to get some information concerning the man for themselves. It is obviously useless to encourage the children to read about the man until they have read some portion of his writings.

* Grove's *Dictionary of Music* gives 1809 as Chopin's year of birth, but it is, I believe, proved that he was born in 1810.

Such a list of books would be more useful for the secondary school. It should be *annotated* by the teacher, in order that the child may know something of the probable contents of the book. The poet should be studied, if possible, during the whole term. The exercises set for the children might very well include the writing of short memorial stanzas, the best of which should be read to the class on the selected day. A class motto should be put on the board from time to time, and remain there for a few days. The upper standards will probably read such poems as "The Lady of Shalott," "Morte d'Arthur," "Sir Galahad," "Ulysses," "Tithonus," "The Lotus-Eaters," "Ode on the Death of the Duke of Wellington." When "Morte d'Arthur" is being read, we might choose as our class quotation :—

> "More things are wrought by prayer
> Than this world dreams of."

For the lower standards there are plenty of poems available, such as "What does little Birdie say?" and "Sweet and Low." The last beautiful melody from the "Princess" is known in nearly every school, but the author's name is ungraciously concealed from the children. With an upper standard it may be possible to get some of the best children to compose a class song. At least some well-known poem which has already been set to music should be learnt, so that it may be sung on the commemorative occasion. "Crossing the Bar" has been set to music by Charles Willeby, and is published by the John Church Company for 2s. "Break, Break, Break," has also been set to music by Lewis Carey, and is obtainable from Boosey and Company (price 1s. 6d.). The former poem, set to music, is also published by Pitman, Hart, and Company, Paternoster Row (price 2d.).

One other piece of advice seems to me necessary. Encourage the children to collect for themselves illustrative material, such as photographs and the pictures of Tennyson's homes from magazines and other sources. Let them bring these to adorn the classroom. In these and many other ways may preparation be made for a fitting commemoration.

Let me now outline a programme for older children suitable for elementary or secondary schools :—

I.—Recitations and readings from Tennyson by the teacher and children.

II.—Songs: for example, "Crossing the Bar," "Break, Break, Break," "Come into the Garden, Maud," "Sweet and Low."

*N.B.*—These would, of course, be more effectively interspersed with the recitations and readings.

III.—Two or three of the best memorial verses to be read by the children; one or two of the children also to give a eulogy of the poet.

*N.B.*—This would give the teacher an opportunity of seeing how far they had benefited by reading for themselves.

IV.—Selected tableaux from "Idylls of the King," prepared and arranged by the children themselves.

V.—A lecture on Tennyson by the teacher, using lantern slides and focussing the attention not on mere biographical details but rather on such things as the country in which Tennyson lived—his association with, for instance, Somersby, Lincolnshire; Farringford, Isle of Wight; and Haslemere—his friendships with Fitzgerald, Lord Houghton, and Hallam.

VI.—A dramatic representation of scenes from the dramas. *(To be continued.)*

# OUR COOKERY COLUMN.

BY ROSAMOND CANDY, FIRST-CLASS DIPLOMÉE, NORTHERN COUNTIES SCHOOL OF COOKERY.

[NOTE.—Our esteemed contributor wishes to apologise for an error in the recipe for "Dropped Scones" given last month. For "half an ounce of cream of tartar," please read "half a *teaspoonful*." A diligent reader of our Cookery Column suggests that the first direction solves the problem of aerial flight, and that the title ought to be "*Raised* Scones."—ED.]

## NOTES ON PASTRY-MAKING.

PASTRY-MAKING is often regarded as a great undertaking, and so in most households is not attempted to any great extent.

So varied are the kinds and methods of making pastry that an article on this much neglected culinary art will not be amiss this month. It is by no means a difficult process—in fact, quite the reverse—if a few simple rules are *carefully* carried out.

The first matter of importance is to decide on the kind of pastry to be made, as so many fall into the mistake, when making a certain pastry, of using the *methods* of two or three kinds, the result naturally being far from satisfactory.

It is always important to have good flour and good butter—although where economy is to be strictly considered, good lard and dripping form admirable substitutes, and make excellent flaky and short crusts.

It is not advisable to attempt *puff pastry*, unless careful attention and ample time can be given to it, and for ordinary purposes short and flaky pastry will be found equally satisfactory.

The variety in pastry depends chiefly on the manner in which the butter is added to the flour.

The following are the chief kinds:—Short-crust, flaky pastry, rough puff, puff pastry, raised-pie pastry, suet crust, and choux pastry.

### RULES FOR PASTRY-MAKING.

1. Everything in connection with pastry must be kept as cool as possible. 2. Use the best flour; pass this through a sieve with the salt and baking-powder when used. 3. Use water very sparingly, especially in making short-crust. 4. In making short-crust the butter must be carefully rubbed in with the *tips* of the fingers until it looks like bread-crumbs. 5. Always mix the pastry with a knife. 6. Use very little flour when rolling out the pastry, merely dusting the board and pin; never flour the pastry. 7. Have a very hot oven for puff pastry, and a cooler one for short-crust. 8. Avoid opening and shutting the oven door frequently, as a draught into the oven will make the pastry sink. 9. Never remove the pastry from oven until quite cooked. 10. Allow the pastry to cool down in a warm place. 11. Pastry will keep a long time if stored in a dry, well-ventilated place. 12. For glazing pastry use the white of egg with a little water added. Brush over the pastry. For tarts add a little castor sugar.

### RECIPES FOR PASTRY.

**Short-crust (household).** *Ingredients.*—One half-pound flour, one quarter-pound butter (lard or dripping), one half-teaspoonful baking-powder, one pinch salt, water to mix. *Method.*—Add salt and baking-powder to flour; pass through a sieve; rub the butter with the flour until the mixture has the appearance of bread-crumbs; add enough water to form a STIFF paste; roll out once, and it is ready for use. Bake in a moderate oven.

**Rich Short Pastry** (for cold fruit tarts). *Ingredients.*—One half-pound flour, five ounces butter, one yolk egg, one pinch salt, one half-teaspoonful baking-powder, water to mix. *Method.*—Add salt and baking-powder to flour; rub the butter lightly into the flour; add the yolk of egg, and mix to stiff paste with a little water; roll out and use.

NOTE.—For sweet dishes a teaspoonful castor sugar may be added to the pastry if liked.

**Flaky Pastry.** *Ingredients.*—One pound flour, one pinch salt, one half-pound to three-quarter pound butter or lard, one half-pint cold water, one teaspoonful lemon juice or one teaspoonful baking-powder, one yolk egg (optional). *Method.*—Add salt and baking-powder to flour; pass through a sieve; divide the butter into four portions; cut up one of these portions into the flour, and mix to a paste with water; roll this out into a long strip on the board; place one other portion of butter in pieces on this strip of pastry; fold into three, and give the pastry a half turn to bring folded edge to the right-hand side; seal the ends; roll out into long strip again, and add one other portion of butter as before; fold again, and repeat until the butter is all rolled in, when the pastry is ready for use. The pastry is improved by standing it in a cool place an hour or two before cooking. This pastry should be rolled out five times in all.

NOTE.—The success of this pastry is in the folding and turning. It must be folded so that the layers are all lying the same way, otherwise the pastry will not rise up in flakes.

**Rough Puff.** *Ingredients.*—One half-pound flour, six ounces butter, one pinch salt, water to mix. *Method.*—Add salt to flour, and pass through sieve; cut up the butter into the flour in rough lumps; add water gradually, and mix (care must be taken not to break up the butter in mixing); turn out on board and roll out thinly into long strip; fold this into three and turn the folded edge to the right (as in flaky pastry); seal the ends, and roll out again into long, thin strip; repeat this five times altogether. The pastry is ready for use.

**Raised-Pie Crust.** *Ingredients.*—One pound flour, one quarter-teaspoonful salt and pepper, five to six ounces lard, one yolk egg, one pint milk. *Method.*—Add salt and pepper to flour; add yolk of egg; melt lard in milk, and add to rest of ingredients; mix until smooth.

NOTE.—This pastry must be made up *hot*, otherwise it will crack.

**Puff Pastry.** *Ingredients.*—One pound flour, one pound butter, one yolk egg, one pinch salt, one teaspoonful lemon juice, one half-pint cold water. *Method.*—Pass flour through sieve; add salt, yolk of egg, and lemon juice; mix to paste with the water; turn this on to floured board, and work the paste until quite smooth and not too stiff. The paste should be of the same consistency as the butter. Press all the water out of the butter by squeezing it in the corner of a cloth, and if the butter be hard work it until it becomes supple and less liable to break up when rolling; form into a block; roll out the paste into an oblong shape twice the size of the block of butter; place the butter at one end of paste, and fold over the other half; seal the edges, and turn the folded edge to the right; press the pastry with pin several times in ridges; roll out into long strip; fold in three, *always turning folded edge to the right;* repeat this seven times. The pastry should be allowed to stand fifteen to twenty minutes in a cool place between every other rolling.

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NOTE.—(1) Puff Pastry is much improved if made the day before it is cooked. (2) Care must be taken not to *over-roll* the pastry. This will easily be detected, as the pastry becomes rubber-like and is rolled out with difficulty. It may be remedied by setting it aside for a little time to recover. (3) The pastry must on no account become warm and oily, which causes the butter to break through the pastry and disaster follows. The hands must be quite cool and also everything about the pastry. (4) For inexperienced pastry makers one half-pound of pastry is quite enough to work at one time, and never on any account should more than one pound be worked at once—that is, one pound butter and one pound flour, etc.

**Suet Crust.** *Ingredients.*—Half-pound flour, one quarter-pound suet, one quarter-teaspoonful salt, one half-teaspoonful baking-powder, water to mix. *Method.*—Add salt and baking-powder to flour, also the suet, finely chopped or grated; mix to *stiff* paste with water, and roll out to size required.

**Choux Pastry.** *Ingredients.*—One quarter-pint water, two eggs, two ounces flour, two ounces butter. *Method.*—Put water and butter into saucepan, and bring to boil; add gradually the flour; stir until quite smooth; allow to cool a little, and add the eggs, well beaten; beat the mixture thoroughly; bake on a tin until firm and brown. The mixture is generally forced through a bag and forcer on to the tins, and is made into éclairs and other cream puffs. It is sometimes served in soup in little round balls.

**Éclairs.** *Ingredients.*—Choux pastry, one half-pint cream, icing. *Method.*—Prepare pastry, and force on to tin in finger shapes; bake in quick oven for half-hour, and when done split down side with knife; allow to cool, and then fill centres of éclairs with whipped cream; dip into any kind of icing (chocolate, coffee, etc.), and allow to set.

The following are a few of the many ways of using puff pastry, although flaky may be substituted in many cases:—Almond cheese-cakes, lemon cheese-cakes, macaroon cheese-cakes, mince pies, cornets à la crème, various jam puffs, sausage rolls, savoury patties, Banbury cakes, Eccles cakes, etc., ham and veal pie (flaky), fruit tarts.

**Macaroon Cheese-cakes.** *Ingredients.*—One half-pound puff or flaky pastry, one quarter-pound ground almonds, one quarter-pound castor sugar, whites two eggs, a few drops almond flavouring, one teaspoonful rice flour, a little jam. *Method.*—Roll out pastry thinly; line some patty pans with rounds cut out of pastry; place a little jam in each, and fill with almond mixture made by mixing all the dry ingredients together and adding the beaten whites of eggs; place a teaspoonful of mixture in each case, and bake fifteen minutes.

**Sausage Rolls.** *Ingredients.*—One half-pound puff or flaky pastry, sausage meat. *Method.*—Remove the skin from sausage; roll out pastry thinly; cut into strips about four inches by two; place a little sausage meat on one strip; damp the edges, and cover with another strip; glaze with white of egg, and bake quickly for twenty minutes.

NOTE.—The rolls may be made by cutting squares of pastry and placing sausage meat on one half and rolling the other half over, but if made by using the two strips the pastry rises much better. This is purely a matter of taste.

**Eccles Cakes.** *Ingredients.*—One half-pound puff pastry, one quarter-pound currants, two ounces candied peel, two ounces butter, two ounces sugar. *Method.*—Roll out pastry, and cut into rounds with pastry cutter; slightly melt the butter, to which add sugar, currants, and chopped peel; put a teaspoonful of this mixture into the centre of each round of pastry, and draw the edges of the pastry together; turn over and roll out to size required; cut two or three times across the cake with sharp knife; glaze with egg, and cook in quick oven for fifteen to twenty minutes; serve with dusted sugar sprinkled over cakes.

**Cream Buns or Angel Cakes.** *Ingredients.*—Choux pastry, cream. *Method.*—Prepare the pastry as in recipe, and put little piles on a baking sheet; bake in hot oven, and when cooked split open and fill with whipped cream.

**Savoury Patties.** *Ingredients.*—Scraps of pastry, minced meat (well seasoned). *Method.*—Cut out rounds of pastry, and with smaller cutter make an incision in centre of rounds; bake in hot oven for twenty minutes; remove the centre round (which will be quite simple), and fill up the pastry with the mince thoroughly heated; replace the small round, and serve.

**Ham and Veal Pie.** *Ingredients.*—One half-pound pastry (flaky), one pound lean veal, one quarter-pound ham, two hard-boiled eggs, seasoning of salt and pepper, white stock. *Method.*—Cut up the veal and ham in squares, and season well with pepper and salt; place a little chopped parsley in bottom of pie-dish; put a layer of veal and ham, and then arrange the hard-boiled egg until the dish is quite full; add a little stock, in which the bones have been well boiled; place on the pastry, and decorate the pie; glaze with white of egg, and put in hot oven for half-hour to cook the pastry nicely, and afterwards reduce the heat of the oven, and allow the pie to cook very gently for one hour; serve cold with salad.

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## BOTANICAL STUDY.

THE LIFE HISTORY OF THE BEAN PLANT—*Continued.*

6. *The factors of germination.*

Chiefly three:—(i.) Water, (ii.) heat, (iii.) air.

### *First Factor in Germination.*

*Water* ($H_2O$).—Experiments to prove that seeds will not germinate without water are well known to every teacher, but the following experiment to show how the water enters a seed is instructive. Take twenty dry beans; divide them up into two groups, each group weighing about the same; take one group and varnish over the hilum of each bean with black (cycle) varnish; take the other group and make an equivalent streak of varnish on the side of each bean. (The object of this is to keep the weight as constant as possible.) Soak all the beans in water for a night. The next morning rapidly dry them with a clean cloth (or blotting-paper), and weigh the two groups again. Then let the children try to answer the following questions:—

Which of the two groups weighed the most? and why? How had the water got in?

### *Second Factor of Germination.*

*Heat.*—To show that some degree of warmth is necessary for germination, the beans should now be planted in twos in little pots of soil, and the pots placed in situations where there is likely to be a considerable difference of temperature—for example, outside, in the schoolroom, in the kitchen. In a fortnight or three

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weeks' time let the children note which pots are coming on the best.

The teacher should point out that whilst seeds will germinate within a considerable range of temperature, there is always a *minimum* temperature below which they will not germinate, and a *maximum* temperature beyond which they will not germinate. Between these two temperatures (but not necessarily the mean) is the most favourable (*optimum*) temperature. Thus :—

*Wheat* has a minimum temperature of germination at 5° C., a maximum at 42.5° C., and an optimum at 28.7° C.

*Flax* has a minimum temperature of germination at 2° C., a maximum at 28° C., and an optimum at 21° C.

*Note.*—A keen teacher would illustrate this experimentally. The knowledge of these critical temperatures is most important when suitable crops for colonies and newly-discovered lands are in question.

### *Third Factor in Germination.*

*Air.*—It is not easy to design very easy experiments to show the importance of this factor. The following are perhaps the best, and require comparatively simple apparatus.

(i.) Germinate some mustard and cress seed on damp blotting-paper in two small equal-sized flasks. Fill one with carbonic acid gas and cork up tightly, and close the other with a wad of cotton wool. Note in which flask the seeds will germinate the best.

(ii.) Take two small equal-sized wide-mouthed bottles fitted with good corks. Fill the first for a quarter of its depth with a strong solution of pyrogallic acid, in which a small piece of caustic potash has been placed. Take a small piece of the damp blotting-paper upon which the mustard and cress seeds are just beginning to germinate, insert it into the little bottle, clamping it by means of the cork, so that it nowhere touches the solution. Fill up the second bottle in the same way, only using water in place of the pyrogallic acid solution. Note in a few days in which bottle the seeds are germinating best.

This experiment depends upon the fact that an alkaline solution of pyrogallic acid rapidly absorbs all the oxygen out of the air. This substance can readily be purchased at any photographic chemist's.

*Note.*—The little piece of caustic potash should not be put in the bottle until the very last moment before corking up. This is a very pretty experiment, and invariably succeeds if ordinary care is taken in setting it up.

The following experiment may be attempted :—

(iii.) Enclose a number of germinating peas in a fair-sized flask ; cork tightly ; leave them for twenty-four hours in the dark ; then remove the cork and plunge a lighted taper into the flask. It will be extinguished. The teacher must then show the presence of carbonic acid gas by the usual tests, and its origin from the respiring beans.

*Note.*—This experiment is best performed in warm weather. The proper explanations can be better made when a lesson on the respiration of plants is given to the higher standards.

## ANIMAL STUDY.

### The Wild Rabbit—*Continued.*

B. *The Appendicular Skeleton* (*continued*).

2. The fore limbs.

(*a*) The upper arm bone (*humerus*). (See Fig. 1.) Note how the "head" articulates by means of the glenoid cavity with the shoulder-blade, making a true ball and socket joint ; and what a beautiful hinge joint the distal end of the bone makes with the sigmoid notch of the ulna. Children must be made to rotate their arms and bend their elbows.

(*b*) The lower arm bones (*ulna* and *radius*.) (Fig. 2.)

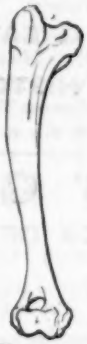

Fig. 1.—Humerus of Wolf. (*a*) Proximal end. (*b*) Distal end.

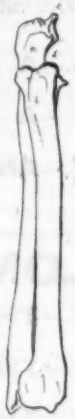

Fig. 2.—Right Ulna (*a*) and Radius (*b*) of Wolf. Note how radius crosses the ulna. (*c*) Elbow. (*d*) Sigmoid notch.

Let a child hold out its arm with the palm of the hand turned towards the ceiling ; this is the *supine* position. When the arm is in this position the *radius* is always on the outside—the thumb side—and lies parallel to the *ulna*. Now let the arm be slowly rotated until the palm is downward ; this is the *prone* position. In this position the distal end of the *radius* has crossed over the *ulna*, and is now on the inner side, the proximal end remaining as before, on the outside. The children will note that the *radius* of all animals which have the fore feet practically fixed in the prone position always

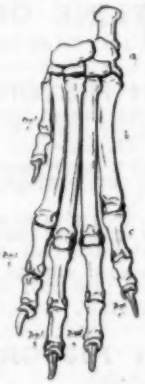

Fig. 3.—Left "Hand" of Wolf. (*a*) Carpals. (*b*) Metacarpals. (*c*) Phalanges.

Fig. 4.—Right Femur of Wolf.

crosses the *ulna*. This is very well seen in the rabbit. The chief points of observation with regard to the *ulna* are—(i.) the projecting elbow, (ii.) the sigmoid notch.

*Note* (i.).—The teacher must point out that the presence of the two bones (*radius* and *ulna*) in their com-

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pleteness implies considerable power of rotation; but in the rabbit this power is clearly lost, though it was probably present in the remote ancestors of the species. One of the two bones is frequently *vestigial* (explain)—for example, in the sheep only the "elbow" of the *ulna* remains, but the *radius* is fully developed. In the bat the *ulna* is vestigial, and the *radius* very long and well developed.

*Note* (ii.).—Higher standards may be taught the meaning of the term "proximal" for that end of a long bone nearest the body, and "distal" for the end farthest away from the body. (See Fig. 1.)

(*c*) The wrist bones (*carpals*), about seven small bones. (Fig. 3*a*.)

(*d*) The hand (*manus*).

(i.) The bones of the palm (5) (*metacarpals*). (Fig. 3*b*.)

(ii.) The fingers (5) (*digits*). (Fig. 3*c*.)

FIG. 5.—TIBIA AND FIBULA OF WOLF.
(*a*) Tibia. (*b*) Fibula.

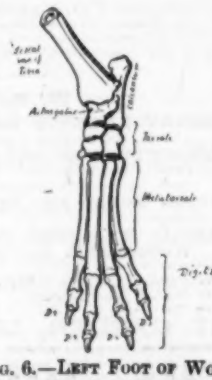

FIG. 6.—LEFT FOOT OF WOLF. Notice the claw-like shape of the third phalanx on each digit. The real claws fit upon these like fingers into a glove. The first digit is absent.

The numbering of the digits is very important. Let the hand be held in the *prone* position; then the digits are numbered 1 to 5 from the inside to the outside—the thumb being No. 1, and the little finger No. 5.

Each digit except the first has three joints (*phalanges*). The thumb has only one *phalanx*. The distal phalanx in each digit is covered with a long horny nail termed a "claw." Notice also that the soles of the fore feet are covered with hair. (Compare cat and dog.)

3. The hind limbs.

These are strictly comparable with the fore limbs, bone with bone.

(*a*) The upper leg bone (*femur*) (Fig. 4), articulating with *acetabulum*. (See pelvis below.)

(*b*) The lower leg bones (*tibia* and *fibula*) (Fig. 5). Notice that the *fibula* is becoming obsolete, and is always on the outside. Note knee-cap.

(*c*) The ankle bones (*tarsals*), seven in number. (See Fig. 6.) Note the long heel bone (*calcaneum*) projecting behind and the bobbin-like *astragalus*.

(*d*) The foot (*pes*).

(i.) The bones of the instep (*metatarsals*)—four.

(ii.) The toes (*digits*)—four.

The toes are numbered in just the same way as the fingers. The great toe is absent, though sometimes it is vestigial. Each toe has three joints (*phalanges*).

4. The hip girdle (*pelvis*) consists of two halves. Each half is an *innominate* bone. Each *innominate* bone consists of three fused bones.

(i.) The uppermost is the *ilium*.

(ii.) The front one is the *pubis*.

(iii.) The back one is the *ischium*.

Just where the *ilium* and *ischium* meet is a deep cavity—the *acetabulum*—in which the head of the upper leg bone works, forming a ball and socket joint. The main points of interest in the *pelvis* are:—

(i.) The mode in which the upper bones (*ilia*) are soldered to the large transverse processes of the first *sacral vertebra*; and

(ii.) The deep *acetabulum*.

The relative size of the pelvis in animals which walk upon four legs should be compared with the relative size of the same structure in animals which walk upon two legs.

(*To be continued.*)

## MEDICAL INSPECTION.

TO THE EDITOR.

SIR,—I have read Mr. Leather's article in your February issue with great interest, and as you invite discussion I should be glad to put before your readers another view of the question.

The serious extent to which physical defects in children is extending may at once be admitted. Personally, I have just finished tabulating and analysing the results of the first year's working under the Act in a town of 35,000 people. There were upwards of 2,000 inspections, principally first inspections—that is, of children recently admitted to the schools. The town is mainly manufacturing, there are no slums, access to the country is easy for all, and the parents generally are of the artisan class. The children are fairly well nourished, and are generally up to the proper standard of height and weight. But *it is rare to find a child who is perfectly fit.* This is a serious but an absolutely true statement. Sixty-seven per cent. have defective teeth; 37 per cent. defects of the throat (adenoids, enlarged glands, etc.); 13 per cent. are myopic; 10 per cent. have pediculi in the hair, with the inevitable corollary of scalp eczema, etc. In 97 per cent. of the cases the parent was present at the examination, and willingly assisted the medical officer with particulars of past history, and discussed with him the defects pointed out. We have collected a large set of statistics, but the inevitable question arises with us, as with every one, *Cui bono?*

The first and most satisfactory result has been that many parents have at once placed the children under medical treatment—adenoids have been removed, glasses have been provided, carious teeth have been stopped or extracted; but this has only obtained with comparatively few cases, say 12 per cent. of the parents. The rest have done nothing; they view their responsibilities with criminal indifference, which arises in most cases from crass ignorance. They pin their faith in some trumpery and cheap remedy obtained from a chemist, when what is needed is continual watching and maternal care.

The suggestion as to the establishment of school clinics is largely impracticable and futile. In the first place, the enormous cost will come on the Education rate, and as the incidence of this is at present iniquitous, further taxation will only increase the injustice. Just fancy, a man living in a house rated at £20 in one part of England pays 6s. a year as his contribution to national education; in other places another man pays 66s.! Why should the clean and careful parent pay for the dirty and careless? Machinery is already provided in the Poor Law Acts for looking after children of the destitute poor, and that should be put in motion.

Again, suppose you establish these clinics with a complement of nurses, and you treat cases of ringworm, eczema, otorrhœa, itch, etc., the children return to infected houses, and the good is entirely undone. For example, in one instance a whole family was excluded from school for thirty-nine consecutive weeks for itch, because as fast as the medical officer cured one child others developed the disease—the whole house was full of it!

I had a case reported to me the other day of children excluded for dirty heads. The father was summoned before the School Attendance Committee. He was a clean, respectable man, in regular employment on the railway, and appeared genuinely distressed and anxious for his children. I had investigations made,

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and found that the mother was, and *always had been*, a mentally defective, who blandly admitted everything, and cordially agreed with all that was said in condemnation of her conduct. The house was filthier than many pigsties, and the children (four in number) slept on heaps of putrid rags and straw, which were literally alive with vermin. What good would a school clinic do in such a case?

The remedy, to my mind, lies in two directions—(*a*) The proper and compulsory education of girls in the duties of housewifery, cooking, and the care of children, and the prohibition of marriage to all those who fail to pass a standard examination in these subjects. What is the use of teaching a girl complex fractions and compound interest when she comes to school with holes in her stockings and a halo of rags dangling from her underclothing? (*b*) The rigid application of Section 12 of the Children Act, which comes into force on April 1. Under this, a parent who fails to provide proper food, clothing, medical attendance, etc., for his child, or who, being unable to obtain the same, has not applied to the Poor Law officers for it, is liable (1) on conviction under indictment to a fine of £200 or two years' imprisonment; or (2) on summary conviction to a fine of £25 or six months' imprisonment. This is putting the responsibility on the right person; and if the clause is not stultified by squeamish sentimentality, the next six months should show a revolution in the state of the children in the schools. Personally, I have little faith in much good coming from it. We live in an age of much preaching and little practice, and the law, except in a few cases, will remain a dead letter.

In conclusion, I have every sympathy with the suffering little ones, but I do object to the removal of parental responsibility, and curing an evil is never so good as preventing it.

FIAT JUSTITIA.

# French Prize Competition.

**All French translations must be received not later than April 6, 1909, and addressed to:—PRIZE EDITOR, Office of *The Practical Teacher*, 35 and 36 Paternoster Row, London, E.C.**

**A Prize of Half a Guinea is offered for the best rendering into English of the following extract:—**

Je ne sais pourquoi les cimetières turcs ne m'inspirent pas la même tristesse que les cimetières chrétiens. Une visite au Père-Lachaise me plonge dans une mélancolie funèbre pour quelques jours, et j'ai passé des heures entières au Champ-des-Morts de Péra et de Scutari sans éprouver d'autre sentiment qu'une vague et douce rêverie; est-ce à la beauté du ciel, à l'éclat de la lumière, au charme romantique du site que se doit attribuer cette indifférence, ou bien aux préjugés de religion, agissant à votre insu et vous faisant mépriser des sépultures d'infidèles avec lesquels on n'a aucune solidarité dans l'autre monde? C'est ce que je n'ai pu bien démêler, quoique j'y aie souvent réfléchi; cela tient peut-être à des raisons purement plastiques. Le catholicisme a entouré la mort d'une sombre poésie d'épouvante inconnue au paganisme et au mahométisme; il a revêtu ses tombeaux de formes lugubres, cadavéreuses, combinées pour causer la terreur, tandis que les urnes antiques s'entourent de gais bas-reliefs où de gracieux Génies jouent parmi les feuillages, et que les cippes musulmans, diaprés d'azur et d'or, semblent, sous l'ombre de beaux arbres, plûtot les kiosques de l'éternel repos que la demeure d'un cadavre. LÀ-bas j'ai souvent fumé ma pipe sur une tombe, action qui me semblerait irrévérente ici, et pourtant une mince lame de marbre me séparait seule du corps inhumé à fleur de terre. Plus d'une fois j'ai traversé le cimetière de Péra, par les clairs de lune les plus fantastiques, à l'heure où les blanches colonnes se dressent dans l'ombre, sans que mon cœur battît une pulsation de plus, prouesse que je n'exécuterais au cimetière Montmartre qu'avec une invincible horreur, des moiteurs glacées dans le dos et des tressaillements nerveux au moindre bruit; mais, en Orient, la mort se mêle si familièrement à la vie qu'on n'en a plus aucun effroi.

*From "Constantinople," by* THÉOPHILE GAUTIER.

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### REPORT.

A large number of very good papers has been sent in this month. *Le sens du relatif* was taken by a few to mean the power of relating, or narrating. *Monsignori* was not understood by some. It is an ecclesiastical title, and as such is better left untranslated. *Comme quoi* is an unusual collocation in French, but it is simply equivalent to our conjunction "how." *Le XVIII^e siècle artistique et littéraire* does not mean that that century was an artistic and literary century. It simply means the century viewed under the two aspects mentioned. The Prize Editor much regrets that he has mislaid the address of "Scholastic." His letter will be forwarded on the receipt of a post card giving the address.

### PRIZE TRANSLATION.

In the first place, Voltaire possessed in a pre-eminent degree the sense of relation, the sense of that continuous evolution which pursues its course throughout the ages. While the 17th century preferred to contemplate the steadfastness and immutability inherent in mankind or the world, what Voltaire beheld especially in these was never-ending change. A historian in the genuine acceptation of the word—for the sense of relation is nothing but the historic sense—history from his point of view consists in showing how the mind, the manners, and the laws of a people are modified from age to age. These modifications struck him very specially in the case of ourselves, but he observes them also in the study of peoples less ready to undergo change. "The Spaniards of to-day," he says, "for example, are no longer the Spaniards of Charles Fifth; neither do the English resemble the fanatics of Cromwell's time any more than the monks and monsignori who people Rome resemble the Scipios." Let us cite the introduction to his *l'Histoire du Parlement*, in which he develops the cardinal idea that nothing is immutable, that everything is in a state of flux from one end of the earth to the other, that the science of history is the science of change and development. So progress, in Voltaire's opinion, is the law of the evolution of mankind. Let us compare different times and make our moan if we dare—that is "a reflection which we should make on almost every page," he writes in his *l'Essai sur les Mœurs*, and he does this himself very often in that work. Doubtless literature and the arts cannot always be progressive; many a time he declares himself that in art and literature the 18th century is not equal to the 17th. The progress he pinned his faith to was the progress of philosophy, and he explains how the 18th century, though inferior to the 17th in its literature, surpasses it in the scope of its intelligence. *L'Essai sur les Mœurs* sketches for us the picture of this development in the past, but it will continue to advance throughout the future ages. Humanity, as the centuries pass, must become better and happier, in proportion as it is enfranchised by reason, and in proportion as its means of action are multiplied and extended by science.

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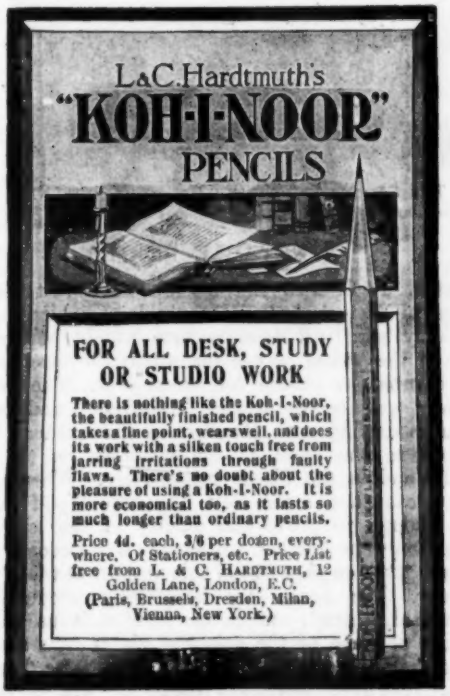
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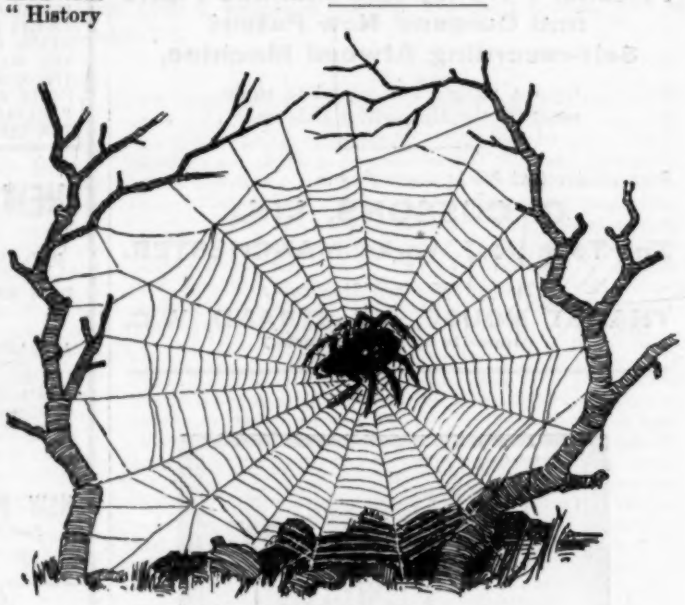

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This is in many ways the best introduction to Pestalozzi which we are acquainted with. Mr. Holman is one of our most sane and lucid exponents of educational theory, and it is no reflection on his other works to say that we regard this as the best he has given us. The plan of the work is admirably suited to those who have no previous knowledge of the master, and no less so to those who may wish to unify and complete former impressions. Dealing first at some length, sufficient to preserve the interest, with the chequered life-story of Pestalozzi, in the later chapters the writer describes and analyses, and in a sympathetic spirit criticises, his methods of teaching the various subjects of his school curriculum. The purpose and aim of the work is incidentally revealed on its last page, where the author gives a short list of books dealing not only with Pestalozzi himself, but also with the subjects which will be most likely to produce modern Pestalozzis among the teachers of to-day; throughout the book, indeed, we feel that Mr. Holman's primary interest in writing lies not with the individual and his work, though that is adequately treated, and with unusual felicity, but rather with the perennial problems of education themselves.

On laying down this study of Pestalozzi, one has the feeling that we are now happily better able to understand the man and his ideals than our predecessors or even we ourselves were two or three decades ago. We have gradually arrived at something like the same sympathetic outlook on the individual child, and our conception of all that is implied in the term psychology is wider, more human, and more helpful. And on this account we welcome Mr. Holman's work also, as he has done much to foster among the teachers of to-day that spirit which was the inspiration of Pestalozzi, his spiritual kinship with the master making him a specially capable interpreter.

*Intermediate English Grammar. By A. J. Ashton, M.A.* (*George Bell and Sons.* 2s.)

This volume is based on the corresponding work of C. P. Mason, and is "augmented and revised in accordance with modern requirements." Those of us who were brought up on Mason's Grammars can testify to the reality of the intellectual interest they aroused, and to their bracing mental effect. But, says Mr. Ashton, "practical teachers have pointed out that in these works the subject matter is too highly packed, and needs a process of simplification." This has been accomplished by the editor in a helpful manner without spoiling the original work, and with due reverence for Mason's views, which in many respects, we need scarcely say, were not those of modern teachers of the English language. But Mr. Ashton has been hampered by the nature of his task.

*A Complete Arithmetic. By M. Eastwood, B.Sc., and J. Lightfoot, D.Sc., M.A.* (*Ralph, Holland, and Co.* 4s. *net.*)

This book has been issued for students who are preparing for examinations in which the theory of the subject, and higher arithmetic generally, are of importance. Among the features of the volume, which is well and clearly printed, are the following:—Decimals as an extension of our ordinary number system are included in the elementary operations. Labour-saving devices are freely used, and some of the short methods are new. Methods for obtaining an approximate result are used throughout, but the student is led to distinguish cases where a more exact result can be obtained, and those where, from the data, only an approximate result is possible. The teacher will find some new methods of computation and suggestions for economising both labour and space. The treatment of percentage and its applications will be found, we think, an improvement. Students preparing for examinations in higher arithmetic will appreciate the numerous worked examples and the full classification of problems. The use of graphs and the limitations of the method are sufficiently illustrated in the text. Apart from the direct examples in the exercises, the problems are largely drawn from papers set at various public examinations.

*The Ruskin Nature Reader—Senior Book. Edited by G. R. Bennett, B.Sc.* (*J. M. Dent and Co.*)

This is an interesting collection of extracts from the works of those men of letters who have written of Nature in her various moods. The authors laid under contribution are Ruskin, White, Miller, Tyndall, Izaak Walton, Thoreau, Lamb, Dickens, Stevenson, Darwin, Jefferies, Hudson, and the poets generally. The passages are well chosen and sufficiently varied in subject. The illustrations are of various types (and quality). The volume will help to link up the newest "subject" with the imaginative side of the curriculum, a consummation devoutly to be wished.

*Elementary Studies in Geography—Lands Beyond the Channel. By H. J. Mackinder.* (*George Philip and Son.* 1s. 9d.)

This is a well illustrated geography reading book of the newer type dealing with the Mediterranean and Europe, and combining history with geography according to Mr. Mackinder's method—history being the handmaid of the author's special subject. "The frequent custom," he writes, "has been to teach geography to children incidentally to history. In my belief, the practice should be the inverse, and history should be taught in order to explain the facts of geography." It is not our business to comment upon this, but to recommend all our readers who are looking for a fresh and vigorous treatment of those parts of Europe which really matter to see this new volume before selecting a journalese "geography reader" of the blatant type.

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7. A man walks at the rate of 6 kilometers per hour. How far will he walk in 2½ minutes? Give answer in feet.

8. A body moves at one instant with a velocity of 20 feet per second, and 6 seconds after it is moving with a velocity of 50 feet per second. Find the acceleration, supposing it to be uniform.

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11. A body starts with a velocity of 1,000 feet per minute, and loses uniformly one-fourth of its velocity in each minute. Find how far it will move before it comes to rest.

12. The speed of a railway train increases uniformly for the first 3 minutes after starting, and during this time it travels 1 mile. What speed (in miles per hour) has it now gained, and what distance did it travel in the first 2 minutes?

13. Two cars, A and B, travel along straight roads, which cross each other at right angles, with velocities of 15 and 20 miles per hour respectively. If B reaches the crossing 1 minute before A, draw a figure showing its subsequent motion with respect to A, and find how far apart the cars are when nearest together.

14. State what is meant by "acceleration" and by "constant acceleration." The units of distance and time being feet and seconds, illustrate your statement by explaining what is meant by an acceleration of 10. Using the same units, two points, A and B, begin to move at the same instant in straight lines; A has an initial velocity of 100 feet per second, and the acceleration of its velocity is 10; B has no initial velocity, and its acceleration is 20. Find (*a*) how many seconds elapse before they are moving with equal velocities, (*b*) the distances that they describe respectively in that time.

15. Employ the graphical method to find the distance traversed in 10 minutes by a train which starts with a velocity of 20 miles an hour, and has its speed diminished at a uniform rate to 5 miles an hour.

16. A train proceeding at the uniform rate of 1,200 yards per minute is 150 yards behind another, which is just starting from rest with a uniform acceleration of 1 yard per sec. per sec. In how many seconds will there be a collision?

17. A body moves over 15 feet in the first second of its motion, over 63 feet in the third second, and over 111 feet in the fifth second. Is this consistent with the supposition of uniform acceleration?

18. Two bodies uniformly accelerated have their velocities increased from $u$ to $v$ and from U to V respectively while passing over the same space. Compare the accelerations and times of describing the spaces.

19. Find what space is described in the second, sixth, and seventh seconds respectively by a body falling freely under the action of gravity.

20. A stone dropped into a well reaches the water with a velocity of 80 feet per second, and the sound of its striking the water is heard 2 $\frac{1}{10}$ seconds after it is let fall. Find the depth of the well and the velocity of sound in air.

21. When is a body said to have uniform velocity? A body is projected from the top of a tower with a velocity of 300 feet per second. It strikes the ground in 5 seconds. What is its distance from the foot of the tower?

22. A ball is let fall to the ground from a certain height, and at the same time another ball is thrown upwards, with just sufficient velocity to carry it to the point from which the first one fell. Show when and where the two balls will meet each other.

23. The wheels of a bicycle are 30 inches in diameter, each crank is 7½ inches long, and is geared so as to make one revolution while the wheels make two. Find the actual velocity of the end of a crank (*a*) when at the highest, and (*b*) when at the lowest point of its path, when the bicycle is travelling with a velocity of 10 miles an hour. Work out the same problem, supposing that two revolutions of the crank corresponded to one of the wheels.

24. What do you understand by relative velocity? One steamboat, A, steams north with a constant velocity of 12 miles an hour. Another, B, steams east with a constant velocity of 16 miles an hour. When A is due east of B it is 10 miles from it. Find the velocity of B relative to A, and the nearest distance to which the boats will approach.

25. State Newton's first law of motion, and explain to what extent it furnishes a definition of the word "force." A cage weighing 4 cwt. is drawn up a shaft with a constant velocity. State what is the tension of the rope, giving clear reasons for your answer.

26. Show how to find the acceleration of a heavy particle sliding down a smooth inclined plane.

27. State Newton's laws of motion. If a body weighing 20 pounds falls 10 feet, what momentum is produced? What will be the answer if the same body falls freely for 10 seconds?

28. Define the terms pound, foot-pound, poundal, and the weight of a pound. Which of these vary, and which do not, at different parts of the earth's surface? A cage is descending the shaft of a coal-mine with increasing velocity. What would be the result of attempting to weigh a body in the cage (*a*) with an ordinary balance, (*b*) with a spring balance?

29. Define force and momentum. How is the force acting upon a body related to the change of momentum produced by it? A jet discharges 100 pounds of water per minute with a velocity of 50 feet per second perpendicularly against a wall. How much momentum is destroyed every minute by the wall, and what force does the water exert upon the wall?

30. The hour and minute hands of a watch which loses 12 minutes per day are 14 and 20 cms. long respectively. With what velocities do the points of the hands describe their circular paths, and what is their relative velocity at noon by watch?

31. A railway train whose mass is 100 tons, moving at the rate of 1 mile a minute, is brought to rest in 10 seconds by the action of a uniform force. Find the magnitude of the force, and how far the train runs during the time for which the force is applied.

32. A stone is let fall from a certain point, and after it has fallen for a second another stone is let fall from a point 144 feet below that point. In how many seconds will the first stone overtake the second?

33. A railway train travels for 20 miles at the speed of 40 miles per hour, 50 miles at 30 miles per hour, and 10 miles at 60 miles per hour. What is its average speed, and how long does it take to make the journey?

34. A car weighing 35 tons is moving on the level at 25 miles per hour. What average force will stop it (*a*) in half a minute, (*b*) in half a mile?

35. A shot whose mass is 700 pounds is moving at 1,000 feet per second, and entering the side of a stationary ship whose mass is 8,000 tons it remains embedded in it. Find the velocity it communicates to the ship.

36. A ball weighing 3 pounds is moving at 60 feet per second, and impinges directly on another ball whose mass is 9 pounds and which is moving in the same direction at 20 feet per second. The two balls move together after impact. Find their common velocity.

37. State Newton's third law of motion, and show how it enables you to determine the velocity of a body moving uniformly when it collides with another body at rest, and the two move together as one after impact.

38. A weight of 100 pounds dropped from a height of 16 feet penetrates the ground to a depth of 3 inches. Find the resistance, assumed uniform, which the ground offers to the motion of the weight. Show that the resistance is not in reality uniform.

39. At 300 revolutions per minute it is found that the piston of an engine when leaving the inner dead point has an acceleration of 400 feet per sec. per sec. The weight of the piston and cross-head is 150 pounds. Calculate the force required to overcome the inertia of these parts.

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